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ABSTRACT

The Teenage Health Teaching Modules (THTM) program is a health education curriculum for adolescents. Each THTM module frames an adolescent health task emphasizing development of self-assessment, communication, decision making, health advocacy, and self-management. This module is designed to improve students' ability to evaluate health research media reports and to locate additional resources to augment information on health research. The outlined activities provide an opportunity for students to: (1) understand the importance of evidence to scientific inquiry and recognize the changing nature of scientific inquiry; (2) identify personal health decisions and the process of using health research information; (3) distinguish between observation and intervention research, and compare the methods and usefulness of both types of studies; (4) learn the definition of "risk factors," and understand probability and its relationship to epidemiological studies; (5) critically analyze health research media reports; (6) learn where to locate additional health information; and (7) assess their knowledge of and attitudes about health research. Appendixes include articles about health news and background information for teachers. (JD)

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Teenage Health Teaching Modules

Using New Health Research

Field Tested and Revised
June 1983

SP026481

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This is one module in the Teenage Health Teaching Modules (THTM) program, a health education curriculum for adolescents developed by Education Development Center, Inc. (EDC) and funded by the Center for Health Promotion and Education, Centers for Disease Control, Public Health Service, U.S. Department of Health and Human Services.

The overall goal of the THTM program is to provide secondary school students with knowledge, skills, and understandings that will enable them to act on behalf of themselves and others in health-enhancing ways. Each THTM module frames an adolescent health task and is designed to help students contribute to their own present and future health and well-being, and that of the families, schools, and communities to which they belong.

The THTM program emphasizes development of the following health skills: self-assessment, communication, decision making, health advocacy, and self-management. For a complete description of the THTM program, additional materials, or assistance in using these materials, please write or call Teenage Health Teaching Modules, Education Development Center, Inc., 55 Chapel Street, Newton, MA 02160, (617) 969-7100. Official health and education agencies may also contact the Center for Health Promotion and Education, Centers for Disease Control, Public Health Service, 1600 Clifton Road, Atlanta, GA 30333, (404)-329-2829 or FTS 236-2829.

Teenage Health Teaching Modules:

Health Is Basic: An Introduction to the THTM Program for Teachers and Students

Understanding Growth and Development

Being Fit

Eating Well

Communicating in Families

Promoting Health in Families

Having Friends

Living with Feelings

Handling Stress

Protecting Oneself and Others: Smoking, Drinking, and Drugs

Preventing Injuries

Improving Health and Safety in the Workplace

Locating Health Resources

Using New Health Research

Acting to Create a Healthy Environment

Planning a Healthy Future

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Special Thanks

The authors wish to acknowledge the central role Ms. Jane Jacobs has played in the development of this module. As Coordinator of School and Youth Health Education at NHLBI,* she recognized the need for improving adolescents' understanding of health research. Ms. Jacobs identified and developed critical concepts and skills essential to such an understanding, and involved expert reviewers in the refinement of the framework. Then, in the spring of 1982, the Center for Health Promotion and Education at the Centers for Disease Control (funder for the THTM Program) entered into an interagency agreement with NHLBI which enabled EDC to translate these concepts into useable curriculum materials. Ms. Jacobs' commitment to the ideas expressed in this module and her close collaboration with EDC have made our efforts both successful and enjoyable.

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*Coordinator of School and Youth Health Education
Office of Prevention, Education, and Control
National Heart, Lung, and Blood Institute
National Institutes of Health

Introduction

Many factors affect the health decisions we make, including peer pressure, family tradition, personal likes and dislikes, level of convenience, time, values, even our moods. In addition, a crucial factor is the new information we receive and our faith or trust in it. But in many areas health information is still open to debate. Health researchers are always uncovering new information that challenges, modifies, or adds to current knowledge. News of this research, carried swiftly by the media, can confuse and overwhelm even the most sophisticated audience.

In response to the abundance of new information, our attitudes can vary from curiosity, frustration, and disinterest to a kind of health news paranoia. When many reports give the same message—regarding the benefits of exercise, for instance—people often act on them "healthfully." But when conflicting or tentative messages exist, many of us shrug our shoulders and wait expectantly for resolution. Others deny or ignore findings and proceed without caution, sometimes with damaging results. Still others decide not to decide, a decision in itself.

The premise of this module is that adolescents, and adults as well, can benefit from health research if they can learn how to evaluate and then incorporate the information into their personal health decisions. We believe it is particularly important for teenagers to understand the research process, because the decisions they make today may establish patterns that stay with them through adulthood. For these reasons, Using New Health Research encourages an open-minded receptivity towards new health information.

How scientists pose health questions and seek results should not be a mystery. The basic notion of science we hope to impart to students is reflected in the following statement from Bertrand Russell:

> It is not what scientists believe that distinguishes them, but how and why they believe it. Scientific beliefs are tentative, not dogmatic...based on evidence, not authority.

Students learn that scientists are people who search for evidence to substantiate their theories about the world. They are encouraged to see that it is the way in which scientists go about trying to understand the world that distinguishes them as scientists. And, because the scientific method requires that investigators be open to new information and new evidence, scientific understanding must be viewed as current but not necessarily final.

It is the evolving nature of health research findings that makes research both exciting and frustrating. It is exciting because it implies new ideas, refinements and revisions, progress and change. It is frustrating, because, especially for the lay person, it can be difficult to make sense of such complexities. It is probably a natural human inclination to desire clear-cut directives, final pronouncements, and guarantees, especially when one's health is at stake. No wonder, then, that many people grow impatient or develop a kind of inertia expressed in comments like "When the experts agree, I'll act."

Instead of creating confusion, controversy should fuel the search for more information. By allowing students to peer over researchers' shoulders, we hope they will catch some of the curiosity that is a contagion in the health field.

It is a fact that the research process is exploratory, that there are few absolutes, that health messages change over time. And yet, we must act, knowing that all the evidence is not in. Through the skills they gain in this module, students should grow in their ability to assess the usefulness of health research information for their own personal decision making. They are taught, for example, to use a series of "smart questions" to evaluate media reports of health research. When this careful evaluation precedes decision making, it can make the difference between hasty or extreme choices and healthful, considered ones.

Health reports often satisfy only some of our questions and leave out much that is necessary for informed decision making. In addition to learning how to scrutinize new health information, students will learn about a variety of resources that can augment what they learn from the media. The module provides them with concrete skills for finding relevant information from such supplementary resources as libraries and local and national health organizations and encourages them to keep looking for new information throughout their lives.

Woven throughout the activities are a set of assumptions or perspectives about the health research process. These perspectives are ones that we believe can enable people to make sense of health research and help them incorporate health research news more meaningfully into their lives. In some cases, the perspectives are made explicit in the activities. In other cases, they form the foundation for the activity but have not necessarily been expressed explicitly. Because they have been a motivating force during the development of this module, we include them here. (The activities to which they most fully pertain are indicated.) We encourage you to share these perspectives with your students and to reinforce them wherever you can in the activities that make up this module.

- Health messages from research can change over time, as scientists make new discoveries; meanwhile, people make health decisions daily. (Activities 1 and 5)

- Reseachers cannot answer some questions expeditiously because there are ethical considerations. Because scientists do not put people into experimental extremes, it is difficult to get clear-cut answers to many research questions. (Activities 2 and 3)

- Most research questions take a long time to investigate. (Activities 4 and 5)

- Legitimate scientific controversies exist. (Activities 4 and 5)

- Researchers draw conclusions from studies of large groups of people. Conclusions about "risk factors" are guides for individual decision making, not guarantees of one's future health. (Activities 4 and 5)

- Research results in new knowledge, but it also uncovers new questions. (Activity 5)

Note to Teachers: You may want to read the article "News from Health Research: Toward a Better Understanding" in Appendix II, Background Information for Teachers. It very clearly presents the theory behind the development of this module. The second article in the Background section, "Statistics and Probability: A Sure Thing for Elementary Classrooms," although directed at elementary level teachers, is just as appropriate at higher levels. It will be particularly helpful if read in conjunction with your preparation for Activity Four, which deals with probabilities.

Goals of the Module

- To encourage and/or reinforce student interest in health research.
- To help students understand the role that information can play in health decision making.
- To increase students' understanding of how health research is conducted and what is realistic to expect from it.
- To improve students' ability to evaluate health research media reports.
- To enable students to locate additional resources to augment information from health research media reports.

Module Overview

ACTIVITY	DESCRIPTION	INSTRUCTIONAL METHOD	# OF CLASS PERIODS
One A Look at Health Research	Discussion and a game establish the importance of evidence to scientific inquiry and lead students to recognize the ever-changing nature of scientific inquiry.	Game	1
Two Applying Health Research to Personal Health Decisions	Students identify personal health decisions and a helpful process for using health research information.	Brainstorming, "Health Decision Log," discussion, homework reading assignment	1
Three How Health Scientists Ask and Answer Questions	Case studies help students distinguish between observation and intervention research, and compare the methods and usefulness of both types of studies. Students learn what a hypothesis is and design studies to test their own hypotheses.	Medical Mystery, discussion, reading assignment, small-group work	2

Note: The numbers of class periods listed for each activity are suggestions only. Teachers are urged to make their own determinations, based on the interests and abilities of their students.

ACTIVITY	DESCRIPTION	INSTRUCTIONAL METHOD	# OF CLASS PERIODS
Four Research Provides Guidelines, Not Guarantees	Students learn the definition of "risk factors," and come to understand probability and its relationship to epidemiological studies.	Discussion, game	1-2
Five Asking Smart Questions	A series of questions helps students critically analyze health research media reports.	Discussion, brainstorming, small-group work	2-3
Six Looking Outside for Information, Looking In At Health Logs	Students learn where to look for additional health information, and explore factors that influence health decisions.	Discussion	1
Seven Health Research Revisited	Using a questionnaire, students assess their knowledge of and attitudes about health research.	Questionnaire, discussion	1

Activity One

A Look at Health Research

Objectives

Cognitive: Students will be able to:

- Recognize that science is a process of inquiry in which scientists refine and revise their understandings of the world.
- Recognize that scientists work by gathering evidence and analyzing it according to accepted standards.

Affective: Students will:

- Take an interest in scientific discoveries related to health.

Skills: Students will begin to:

- Distinguish between medical beliefs that are based on evidence and those that are not.

Activity at a Glance

Through a game, two major concepts are introduced: (1) that scientists look for evidence to understand and explain what they observe, and (2) that they are constantly learning new things because new scientific discoveries may clarify, disprove, or modify earlier beliefs. Science is presented as an ongoing inquiry in which today's conclusions may turn out to be tomorrow's controversy, or, conversely, today's heresy tomorrow's breakthrough.

Preparation

1. Make one copy of the page "Cure or Treatment/Illness or Ailment," and cut up the page so that each item is separate.

2. Refer to "Notes for Teachers on Cure or Treatment/Illness or Ailment Game" and its accompanying definitions, at the end of the procedure section, to prepare for the game.

NOTE: ALL MATERIAL TO BE DUPLICATED FOR STUDENT USE IN EACH ACTIVITY APPEARS ON BOXED PAGES AT THE END OF THE ACTIVITY.

Procedure

1. Explain to students that this module is about the personal health decisions everyone faces and some ways that health research can help in making those decisions. Health researchers are constantly learning new and useful things, but it can be difficult to understand the findings or to know how to apply them. It is easy for everybody, including very well-informed adults, to be overwhelmed by news of health research that is often carried by newspapers, television, or radio, with little or no explanation. Furthermore, scientists themselves may disagree on findings. As a result, the ordinary citizen can end up hearing confusing and sometimes conflicting information: cholesterol is bad for you/cholesterol is okay; jogging is good for your heart/jogging leads to injuries. The upshot of all this confusion is that people may turn a deaf ear to reports of health research, when, in fact, with some basic skills and understanding, they could learn to use health research reports in personal health decision making. In this module, students learn a little about health research—about how scientists go about making discoveries. Armed with that information, they will be better able to decide whether and how to take advantage of health research in their own personal decision making.

2. Put the following two quotes on the board:

   Science is a willingness to accept facts, even when they are opposed to wishes.

   —B.F. Skinner

   Science moves but slowly, slowly creeping from point to point.

   —Alfred, Lord Tennyson

Point out the quotes on the board and explain that students are about to play a brief game to demonstrate what the quotes mean. Distribute the slips of paper cut from the "Cure or Treatment/Illness or Ailment" sheet. Explain that half the people who received slips of paper have "Cure or Treatment" written on their slips. The other half have an "Illness or Ailment." Students should circulate around the room until they find the person whose information goes with the information they hold. That is, they are to match "Cures or Treatments" with appropriate "Illnesses or Ailments." (In classes where it would be inadvisable for students to leave their seats an alternative is to have students call out their particular cure and ask the people holding treatment slips to confer among themselves and then guess which treatment they think that cure goes with.) Assure students that ALL the cures and treatments are real—either they were used at some time in history or they are being used now. None of the cures have been made up!

3. As students match up cures with ills, keep track of their guesses on the blackboard. After each guess, provide them with the right answer (which is provided for you at the end of this procedure section). Do this rather quickly. The idea is not so much to furnish students with a lot of detail, but to impress them with the vast changes in medical knowledge over the centuries.

4. Tell students that scientists are people who look for evidence to substantiate their perceptions. Simply believing that something is true does not make it true. There needs to be evidence. For each pair of cures and ills, ask students to indicate whether they think people believed in the cure because of evidence they had gathered or whether they simply held the belief without any substantiating evidence. At the board record students' answers by marking an "E" (for evidence) or an "NE" (for no evidence) beside each pair.

5. Be sure to tell students that something can be based on evidence and still be wrong, less effective, or less accurate than it was once considered to be. For example, it was commonly believed that the best way to stop bleeding was to cauterize (burn) the wound. This belief was certainly based on evidence, in that the burning did in fact stop the bleeding, but the treatment had a number of severe repercussions, including terrible pain for the patient. The doctor who first suggested that it would be better to stitch an open cut with thread and needle was ridiculed by other doctors of his day. It took many years for his practice to be acknowledged as the superior one, which indeed it is.

6. Next have students indicate which of the cures have been disproven or replaced by more effective methods. Put a "D" next to those.

7. Ask students to refer again to the first quote on the board. How does the exercise they have just done reinforce or explain the quote? Which of the cures indicated that people were accepting wishes rather than facts?

8. Refer to the second quote. Point out how much medical practice and health knowledge have changed over time. Reinforce the notion that this change will never stop, because as scientists learn new things they inevitably discover past misconceptions. Scientists are always refining and revising their understanding of how things work, and, of course, each new discovery leads to new questions. Science is an ever-changing process of inquiry. We will never have all the answers to everything we want to know, but each new discovery contributes to a more complete understanding of our world.

9. Homework: Ask students to keep their eyes and ears open for reports of health research studies. Encourage them to look through the medical section of magazines, to read the daily newspaper, to listen to television and radio. Suggest that they bring in to class copies of printed articles, and the notes of key information provided in radio or television reports.

Notes for Teachers on

Cure or Treatment/Illness or Ailment Game

(See Procedure step #3)

Cure or Treatment	Illness or Ailment
Put goat's cheese on the patient's head...	...to cure a headache.

Notes: This medieval English cure appeared in an Anglo-Saxon medical book published sometime between the fourth and sixth century A.D.

No Evidence (NE), Disproven (D)

Apply a hot iron and cauterize (burn) the tissues...	...to stop bleeding from an open wound.

Notes: Until the middle of the sixteenth century, doctors used a hot iron to burn a large open wound shut. Then Ambroise Pare introduced the technique of stitching blood vessels closed to stop bleeding rather than burning them. At first other doctors questioned his technique, but later it was used widely, especially in military amputations, and reduced patient suffering enormously.

Evidence (E), Disproven (D)

Tie up a spider in a piece of cloth and pin it over the mantelpiece...	...to cure whooping cough.

Note: An old English remedy.

No Evidence (NE), Disproven (D)

Put a spider in a nutshell and wear it around your neck...	...to cure malaria.

Note: An old English remedy.

No Evidence (NE), Disproven (D)

Cure or Treatment	Illness or Ailment
Hold the patient upside down in a hole in a meadow...	...to cure whooping cough.

Note: An old English remedy.

No Evidence (NE), Disproven (D)

Provide quinine...	...to cure malaria.

Note: An Italian scientist, Guido Baccelli, discovered the usefulness of quinine for malaria in 1890.

Evidence (E)

Get regular exercise...	...to reduce chances of heart disease.

Note: People who exercise regularly may have lower resting pulse rates and overall their hearts can better withstand stress.

Evidence (E)

Do not smoke...	...to reduce chances of lung cancer, heart disease, and emphysema.

Note: Many studies confirm the link between smoking and heart disease, emphysema, lung cancer, and other forms of cancer.

Evidence (E)

Apply cool water...	...to reduce the severity of a burn.

Note: People once recommended applying butter or ointment to a burn. We now know that butter simply seals in the heat and allows the skin to continue "cooking."

Evidence (E)

Cure or Treatment	Illness or Ailment
Blood-letting (either by leeching or by opening a vein)...	...to cure any number of common ailments, including head colds, congestion, fever, and rheumatism.

Note: For many centuries, people believed that illness could be cured by relieving the body of "bad" blood. The procedure involved either cutting an opening in the vein or applying leeches (blood-sucking worms) to the body. As many as 10 to 50 leeches could be applied to one patient. In 1833 alone, 41,500,000 leeches were imported into France.

No Evidence (NE), Disproven (D)

DEFINITIONS

Emphysema (Pulmonary emphysema): A condition in which the alveoli (air sacs) of the lungs become distended or ruptured. The most helpful clinical sign is unusual breathlessness. Pulmonary emphysema affects predominantly men between the ages of 45 and 65 and is associated with a history of chronic bronchitis, cigarette smoking, or exposure to cold, damp weather and a dusty work or city environment.

Heart Disease (Cardiovascular disease): This broad term covers a variety of abnormal conditions affecting the heart and blood vessels, all of which involve an impairment of the heart's ability to meet the body's metabolic needs under both resting and stress conditions. The major diseases covered by this term are ischemic heart disease, stroke (cerebrovascular disease), coronary heart disease, high blood pressure, and hardening of the arteries (arteriosclerosis). Currently cardiovascular disease is the leading cause of death throughout the Western world and has twice the mortality (death) rate of cancer. Within the United States more than one million people die each year from cardiovascular ailments. Risk factors include obesity, middle age, physical inactivity, cigarette smoking, high blood pressure, and elevated cholesterol level. Its high prevalence is partly due to the fact that people are living longer and are more sedentary. Since the early 1970s the rate of heart disease in industrialized countries has been declining. The reasons are not yet well understood, but some people hypothesize that the reduction may be due to the fact that many people are eating foods lower in cholesterol, fat, and salt and are exercising more.

Malaria: An acute and sometimes chronic infectious disease caused by a parasite passed into the body through mosquito bites. (Only infected mosquitoes of a certain type can carry the parasites.) It is characterized by high fever, which is often intermittent, and by anemia, enlargement of the spleen, and convulsions. Despite worldwide campaigns aimed at eradication of malaria through the control of mosquitoes, the disease continues to be the principal infectious disease of warm climates. Prevention includes the control of the mosquitoes' breeding cycle and the use of one of several drugs such as quinine. Treatment involves the use of these same drugs.

Quinine: A bitter, white, crystalline alkaloid, derived from cinchona bark, that is used in the prevention and treatment of malaria.

Whooping Cough (Pertussis): A common acute infection of childhood caused by a bacteria, transmitted by air and dust. Whooping cough is characterized by recurrent spasms of coughing ending in a sudden inspiration association with a high-pitched crowing sound or whoop. It is highly contagious and presents a major health problem in many developing countries. It carries a high mortality (death) rate, especially for infants under one year of age. Both the mortality and the morbidity (illness) rate of pertussis are higher for females than for males. As a rule, one attack of whooping cough confers lasting immunity. Cases of, and consequent deaths from whooping cough have declined dramatically in the United States since the 1940s with the increasingly widespread use of standardized vaccines as part of the routine immunizations against diphtheria, tetanus, and pertussis.

CURE OR TREATMENT/ILLNESS OR AILMENT

(Make one copy of this page and cut out each item on the dotted lines.)

Cure or Treatment Put goat's cheese on the patient's head...	Illness or Ailment ...to cure a headache.
Cure or Treatment Apply a hot iron and cauterize (burn) the tissues...	Illness or Ailment ...to stop bleeding from an open wound.
Cure or Treatment Tie up a spider in a piece of cloth and pin it over the mantelpiece...	Illness or Ailment ... to cure whooping cough.
Cure or Treatment Put a spider in a nutshell and wear it around your neck...	Illness or Ailment ...to cure malaria.
Cure or Treatment Hold the patient upside down in a hole in a meadow...	Illness or Ailment ...to cure whooping cough.
Cure or Treatment Provide quinine...	Illness or Ailment ...to cure malaria.
Cure or Treatment Get regular exercise...	Illness or Ailment ...to reduce chances of heart disease.
Cure or Treatment Do not smoke...	Illness or Ailment ...to reduce chances of lung cancer, heart disease, and emphysema.
Cure or Treatment Apply cool water...	Illness or Ailment ...to reduce the severity of a burn.
Cure or Treatment Blood-letting (either by leeching or by opening a vein)...	Illness or Ailment ...to cure any number of common ailments, including head colds, congestion, fever, and rheumatism.

Activity Two

Applying Health Research to Personal Health Decisions

Objectives

Cognitive: Students will be able to:

- Identify a series of steps to help them make better use of health research information.
- Identify personal health decisions they make in their daily lives that have both short- and long-term health consequences.

Affective: Students will:

- Appreciate that health research can help people make better-informed health decisions.

Skills: Students will be able to:

- Log personal health decisions they make in their daily lives.

Activity at a Glance

Students brainstorm the variety of health decisions they encounter in their daily lives and prepare to keep a log that will accurately track the kinds of decisions they actually do make over the course of the module. Then in a brief discussion, students are introduced to a diagram and series of steps that advise them on ways to use health research information to make better-informed health decisions. "A Medical Mystery" is assigned for homework.

Preparation

1. Duplicate, one per student, or copy on the board, "Health Decisions Log," both the blank form and the sample sheet.

2. Bring in folders for students to keep their health decision logs and news clippings in or ask the class to bring in their own folders. (You can give students round head fasteners to use in keeping the papers together.)

3. Duplicate "A Guide to Using New Health Research," one for each student.

4. Duplicate "A Medical Mystery," one for each student, and assign it as a homework reading assignment.

Procedure

1. Before health research information can be useful in personal decision making, users have to be clear about what a health decision is. Ask students to name all the things they do or do not do which can have an effect on their health, now or in the future, and keep track of their suggestions on the board. If they are stuck, point out that we make health decisions all the time. Even choosing not to do something is a decision: to wear or not to wear a seat belt, for instance, or how long to sleep, whether and how much to exercise, whether to smoke, or whether to drink coffee. If students need further suggestions, use these categories to spur their imaginations: foods they eat, substances they take, exercise, sleeping habits, activity, getting or not getting medical help, safety measures, stress.

2. Next explain that some health decisions can have immediate effects--like not having breakfast and getting run down, or choosing not to wear a seat belt, while other decisions set patterns that may have health consequences years later. Examples of decisions made in adolescence that can have far-reaching effects include smoking, exercise, and diet decisions. Unhealthy habits in these areas may not pose an immediate threat to teenagers, but they may mean that as adults they could run a much higher risk of heart attack, stroke, and some other diseases than people who did not establish these early patterns.

Your students, who are, after all, young, energetic, and probably quite healthy, may have difficulty accepting the long-term effects of lifestyle choices on their health. For that matter, many adults discount the role that exercise, smoking, and diet can have on their lives. Furthermore, most research studies focus on adults, making it all the easier for teenagers to dismiss the relevance of the findings.

For all these reasons, it is important to stress that research on adults does have relevance to teenagers, because it is in those years that many lifelong patterns are set. For students who want to know why and how lifelong habits can affect health, refer to other THTM modules. Ones that are most pertinent include Eating Well, Being Fit, Protecting Oneself and Others: Smoking, Drinking, and Drugs, Promoting Health in Families, and Handling Stress.

3. Look at the list of health decisions that have been generated by this discussion and categorize the decisions so that those which could result in immediate health effects are distinguished from those with possible future consequences. For example:

Possible Immediate Effects	Possible Future Effects
Not wearing seat belts	Eating foods high in fat
Riding bike without a helmet	Exercising regularly
Drinking and driving	Getting too little exercise
Getting enough sleep	Smoking

4. Distribute the blank "Health Decision Logs" and the sample log, or, if you have copied them on the board, refer students to them now. Explain that for the duration of the module, you and they will be keeping track of health decisions encountered each day. You will also be recording the factors that influenced you to make the decisions and the outcomes, if any, the decisions had for you. Influential factors might include new health information, time, convenience, what friends do or think, family beliefs and habits, mood at the time, imagination or perception of the situation. Go over the sample log and be sure students understand what they are being asked to do. Ask students to make one copy of the blank form for each of the days they will be keeping the log.

5. Ask students to describe all the health research news they noticed as a result of their homework assignment. What information was reported? Where did they hear about it? What recommendations were made? Have they thought about using the information in any way? Why or why not? Does the report raise more questions in their minds? Do they know where they can go

for answers? While they may not be able to answer all these questions to their satisfaction right now, by the end of the module they should be better equipped to deal with them.

Explain that, in addition to keeping their health decision logs, they should also continue to collect health research news items. These items can be newspaper clippings or brief written summaries of television or radio reports. Have them prepare a folder in which they can keep both their health decision logs and the clippings and summaries they collect. Later in the module they will use these items to create a bulletin board of health research news.

Here is a list of health research topics that are frequently discussed, sometimes with great debate, in the media:

- Food and Nutrition: Controversies over ideal weight; health effects of underweight, overweight; effects of sugar overconsumption; high-salt and low-salt diets; cholesterol; saturated fats; food additives; preservatives; caffeine.

- Vitamin Supplements: Controversies over how many; what kind; in relation to alcohol and smoking.

- Medicines: What's safe to take? For whom? Possible side effects? Difficulties in combination with other drugs; precautions during pregnancy.

- Exercise: What's the right amount? What kind?

- Stress: What role does stress play in disease? How to reduce stress?

- Sleep: How much is necessary? Why?

- Physical Environment: What are acceptable levels of air and water polution? How can we dispose of toxic wastes? Do chemicals in common household products, such as insulation, pose health hazards?

6. Discuss "A Guide to Using New Health Research" with your students, emphasizing the following points:

- Keep trying to learn all you can.

- Don't expect simple, final pronouncements. Because we don't know everything there is to know, there will always be some uncertainty. Meanwhile, we continue to make new discoveries.

- Be aware of the health decisions you make in your own life.

- Be aware of special health problems or potential health problems, like diabetes, overweight, smoking, etc., in your family so you can watch especially for information on those subjects.

- Base your actions on the best information available at the time. (Of course information is only one of the factors that influence our health behaviors. Family preferences, time, convenience, personal attitudes toward and beliefs about health, and many other factors affect health decisions.)

- Keep an open mind.

- Go to other sources to get additional information.

- Evaluate new information.

- Be open to changing your mind. Be adaptable, if the data seems to warrant it.

7. Homework: Distribute copies of "A Medical Mystery" and ask students to read it carefully in preparation for the next lesson.

HEALTH DECISIONS LOG

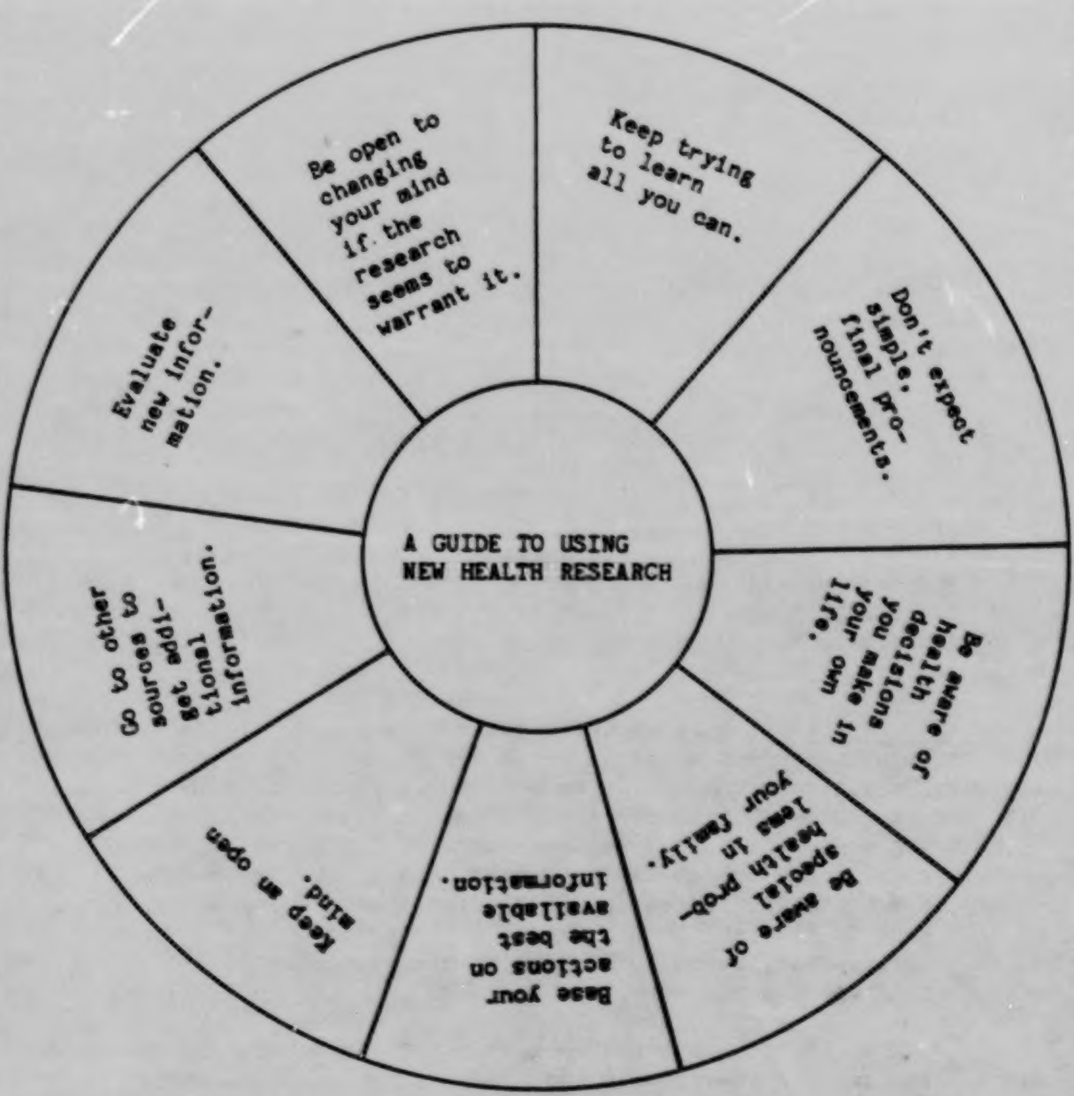
SAMPLE

	Health Decision	Influence	Outcome
Morning	Hate breakfast - but ate fruit and toast anyway	Parents!	More energy
	Rode to school without my helmet	No reason. Felt like it.	Nothing happened, luckily.
Afternoon	Swam after school - 18 laps	I read somewhere that swimming is good for you. Plus, I feel fat.	I felt refreshed.
Evening	Passed up that cigarette Joe offered me!	That report last year in *Time*, and what they said on TV the other night.	Feel better; proud - don't want to start smoking again.
	No coffee tonight	Sometimes it keeps me awake. Besides, I'm confused about that new caffeine report.	Felt more relaxed. Fell asleep easily and slept well
	Had chocolate cake!	*Me*. Tonight I don't care about calories!	Satisfaction

MY OWN HEALTH DECISIONS LOG

Make multiple copies of this form, one for every day you will keep the log.

	Health Decision	Influence	Outcome
Morning			
Afternoon			
Evening			


A GUIDE TO USING NEW HEALTH RESEARCH
Keep trying to learn all you can.
Don't expect simple, final pronouncements.
Be aware of health decisions you make in your own life.
Be aware of special health problems in your family.
Base your actions on the best available information.
Keep an open mind.
Go to other sources to get additional information.
Evaluate new information.
Be open to changing your mind if the research seems to warrant it.

A MEDICAL MYSTERY

Science is nothing but trained and organized common sense.

--Thomas H. Huxley

Scientists are building explanatory structures, telling stories, which are scrupulously tested to see if they are stories about real life.

—Sir Peter Medawar

So far in this module, we have learned that scientists look for evidence to substantiate their perceptions. Simply believing that something is true does not make it so. Scientists gather information, observe it carefully, and try to explain what they observe through logic and analysis. In this reading assignment you will have the chance to see how one medical scientist went about trying to solve the mystery she faced. Notice the ways in which she tried to gather and interpret evidence.

* * * * * * * * * * * * * * * * *

Finally, Dr. Alice Daniels was on vacation. She'd been looking forward to her one-week vacation on a cruise ship for a long time. She hoped it would be a vacation where she could really rest. One week with no work, no interruptions, and no medical research. Her diary tells a different story.

Monday, one day out at sea: Nothing but sun, sea, and plenty of food. It's been almost perfect so far, except for Dr. Fernandez' request this evening. He asked me to look in on one of his patients, a 20-year-old woman who was suddenly hit with chest congestion, diarrhea, and a rash all over her body. Given her medical history, Dr. Fernandez thought it might be an allergy, but she didn't respond to the usual treatments. I'm betting on a bacterial infection. I'll take some samples for culture, and send them to the lab for analysis. We've radioed land and asked them to send a helicopter, so it looks like we can have the lab tests done and back to us in about three days.

Tuesday: Today there were three more cases of people who had the same kind of symptoms: a 50-year-old man, a 65-year-old woman, and a 25-year-old man. Anyway, it doesn't seem to be contagious, since in many cases only one person in a family has been affected. Something's going on right on this ship that's making people sick. But what? It could be a hundred different things....Something in the food, the water in the swimming pool, a drug that they all took?

The captain has asked me to help Dr. Fernandez figure out what's going on. Since my specialty is epidemiology—studying patterns of health and diseases in groups of people—he thought I could help him solve this mystery. Where to start? As usual, I have to identify the

source of the sickness. The patients have something in common. They all did something, ate something, took something that made them sick. The first step is to get the ship's crew talking to the patients who are well enough, or to their families. We'll start with food diaries, and get a listing of everything the patients ate since they've been on board. Might as well start with the hypothesis that food poisoning is causing the problem.

Wednesday. Seven people are sick, all with the same pattern of symptoms. The other passengers are getting scared. I thought I had a clue from the food diaries when I found that all four of the first people to get sick had eaten chocolate pie for lunch or dinner on Monday. But the cook informed me that more than fifty people had eaten the pie, and only four of them got sick. Also, none of today's victims had eaten the pie. Not a bad hunch, but the evidence doesn't back it up. I'm going to keep checking for a pattern in the food diaries, but if nothing turns up soon, I'll have to look for different kinds of clues.

Thursday. The lab results are back, and they confirm that we are dealing with bacteria. Given the number of people who have come down with the symptoms and the fact that it doesn't seem to be contagious, I'm still betting that the bacteria are being transmitted through food. But what is the culprit?

According to the bartender, several of the victims (now there are seventeen sick people) had been in the bar just before they got sick. I asked him what they were drinking, but he couldn't remember. But it's good lead, and I'll get the crew to check it out by asking the patients what they drank in the bar.

Friday. The new evidence is frustrating. It's true. All of the patients had been in the bar, but they all had different drinks. Different drinks, different amounts, with different ingredients. Maybe it's not the drinks. Maybe it's something they ate while they were in the bar. Could the peanuts, potato chips, or another snack be the culprit? Seems like a good guess. I'm keeping my fingers crossed.

Saturday. This could be it! I talked with each of the patients and asked them to describe everything they put in their mouths when they were in the bar. And it looks like all of them ate the maraschino cherries that were served as garnishes with their drinks. I asked a sample of other (nonsick) people who were in the bar whether they had eaten cherries, and in each case, the answer was "no." We're getting some solid evidence now, so I told the bartenders to stop serving cherries with the drinks.

Sunday. Even though maraschino cherries are an unlikely carrier of food poisoning, my guess is that they had been soaking in a solution that contained bacteria, which caused the food poisoning. Of course, I can't be 100 percent sure until I have a lab analysis done on them. Fortunately, most of the patients are feeling better now and we can all enjoy our last few hours on board. Some vacation!

Activity Three

How Health Scientists Ask and Answer Questions

Objectives

Cognitive: Students will be able to:

- Understand that science is systematic common sense and that they are capable of understanding and using scientific methods.
- Distinguish between two broad categories of research studies in which evidence is used to test a hypothesis: observation studies and intervention studies.
- Identify basic research terms such as hypothesis, evidence, and replicability.

Affective: Students will:

- Recognize that they often form hypotheses about their own health and act on the basis of these hypotheses.

Skills: Students will be able to:

- Formulate hypotheses about the effects of a particular health habit.
- Design a simple study to test these hypotheses.
- Apply knowledge of research concepts to their own health decision making.

Activity at a Glance

Students learn to distinguish between observation studies and intervention studies. The concept of hypothesis testing is introduced through a medical mystery and a brief research report. Students discuss these studies and then generate and test their own hypotheses about health.

Preparation

1. For Day One, put the following two quotes up on the board and refer to them as it seems appropriate throughout the lesson.

> Science is nothing but trained and organized common sense.
>
> —Thomas H. Huxley
>
> Scientists are building explanatory structures, telling stories, which are scrupulously tested to see if they are stories about real life.
>
> --Sir Peter Medawar

2. For Day Two, duplicate copies of "Exercise and Heart Disease: An Animal Study," one per student, and "Guidelines for Hypothesis Testing" and "A Glossary of Health Research Terms," one per student.

Procedure for Day One

1. Conduct a class discussion of "A Medical Mystery," which students read as homework. The following questions and discussion points can be used to guide the discussion.

- When Dr. Daniels saw the first patient and found that she had no allergies, she made a guess about what was wrong. What was the guess?

(Scientists often make educated guesses about what causes something to happen or about the relationship between two events. An educated guess, like this, is called a hypothesis. Dr. Daniels' first hypothesis was that bacteria were causing the sickness.)

- What did Dr. Daniels do with this hypothesis?

(Dr. Daniels had laboratory tests conducted to see whether the symptoms were caused by bacteria. The lab test provided evidence that bacteria were present in the specimen Dr. Daniels sent. This evidence allowed Dr. Daniels to see whether her hypothesis was right or wrong; it allowed her to confirm or refute her hypothesis.)

- Dr. Daniels says, "Something's going on right on this ship that is making people sick. But what? It could be a hundred different things...." What are some plausible hypotheses that Dr. Daniels did not come up with?

(Encourage the class to list as many hypotheses as possible. Explain that these are all possible, but that a scientist would be able to choose the most likely ones, based on his or her experience, knowledge of disease, and medical research. Again stress that hypotheses are educated guesses, not wild or random ones.)

- What did Dr. Daniels learn from the laboratory tests?

(She learned that bacteria were causing the sickness. Because of the number of people affected and the fact that it did not seem to be contagious, she concluded that the problem was bacterial food poisoning. But she still had to determine what food was causing it.)

- After collecting the food diaries, Dr. Daniels rejects the hypothesis that the chocolate pie caused the sickness. Why?

(Two reasons: Many people ate the chocolate pie and did not get sick; and some of the sick people did not eat the chocolate pie. Dr. Daniels is still not certain that it was not the chocolate pie or an ingredient in the pie, but the evidence suggests that it is better to move on to another hypothesis.)

- Dr. Daniels discovers that all of the passengers who became ill had been in the bar. If you were a passenger on the ship and she told you about this discovery (before she figured out that the cherries caused the problem), would you go to the bar? Do you think they should close the bar?

(These are the sorts of questions everyone faces upon hearing that scientists are in the midst of investigations which seem to offer some clues but not all the answers. While the scientists are investigating, people still have to go on making health-related decisions. It is not always easy to know whether to change a behavior on the basis of information that is not yet complete. These matters require judgment. Given what evidence exists, and the fact that it is not all in yet, people often have to decide what constitutes a reasonable health risk. Encourage students to decide whether, in this instance, they would go to the bar, and whether or not they think the ship's captain should close it. Be sure they offer reasons to back up their opinion.)

- Dr. Daniels has the crew ask the patients about what they drank in the bar and finds that the new evidence is "frustrating." Why?

(Dr. Daniels is frustrated because she could find no pattern in the evidence. She has had the crew ask patients about the types of drinks they had and the amount they drank, but neither of these factors seems to be related to who got sick. Some patients drank a lot, some a little, and they had many different kinds of drinks.

- Finally, Dr. Daniels comes up with a winning hypothesis. What is this hypothesis and how does she confirm it?

(Hypothesis: Something the people ate while they were in the bar caused them to get sick.

She confirms her hypothesis by asking patients what they ate while they were in the bar. She then asks a sample of well people who were in the bar what they ate. Her evidence is strong, because she finds that (1) all the sick people ate maraschino cherries, and (2) none of the well people she sampled ate cherries.)

- After this discovery, Dr. Daniels says she is still not 100 percent sure the cherries caused the sickness? Why not?

(Dr. Daniels knows that there is a very strong association or correlation between the eating of the cherries and getting sick, but until the lab tests identify bacteria in the cherries she is not sure that eating the cherries actually caused the sickness. For example, it may be that all the people who ate cherries also ate the orange slices. Perhaps it was the orange slices and not the cherries that caused the sickness. She has to rule out this possibility by doing a laboratory test. Even though all the evidence is not yet in, she is sure enough to ask the bartenders to stop serving cherries.)

Again, point out that this is what happens in real life. All the evidence may not be in, but if there is a lot of evidence pointing in the same direction, many people feel it is better to take precautions than to wait for absolute certainty. This is the case, for example, with cholesterol. Many studies show that eating foods high in cholesterol, like egg yolks or liver, and foods high in other kinds of fats (like the saturated fats in meat, butter, and other dairy products) increase blood cholesterol levels. Other studies indicate a relationship between increased blood cholesterol levels and increased risk of serious heart disease. But the controversy over cholesterol is far from settled. Most researchers agree that blood cholesterol levels are tied more to genetic make-up than to diet. The scientific controversy is over whether the 10 to 20 percent change attributable to diet will significantly influence the coronary heart disease rate. National studies are in progress to address this issue.

The issue everyone faces is whether to make a change in diet on the basis of current evidence. In making the decision we need to weigh how difficult—or easy—the change is and what the possible benefits are. In other words, the decision is based on a comparative analysis which weighs the possible effects of not instituting the change with the inconvenience of instituting it. (In this case, Dr. Daniels thought the inconvenience of prohibiting the cherries was far offset by the possible benefits it could bring to the people on the ship.)

2. Explain to students that scientists are not the only people who make educated guesses or hypotheses about the relationship between two things. We make hypotheses all the time in our own lives. For example, a student who is not excelling in a sport might hypothesize "I'm doing poorly because I don't practice enough." There also might be other possible explanations or competing hypotheses such as not being physically suited for that particular sport.

When it comes to health, we often make hypotheses to explain why we feel sick or well. Parents may hypothesize that their children get colds because they play outside in the rain. Teenagers may hypothesize that outbreaks of acne are caused by eating certain foods. Remind students that hypotheses are educated guesses about a cause-and-effect relationship.

To qualify as a hypothesis, the guess must be stated in a way that can be tested. For example, you could test the hypothesis that drinking alcohol before driving increases one's chance of an auto accident. This statement is testable because it is possible to assess whether drivers have been drinking and how many of these have had accidents compared to nondrinking drivers. But the statement "If he were alive today, Christopher Columbus would be an astronaut" is not a hypothesis because there is no way to test it.

3. Homework: Ask students to write down a hypothesis concerning the relationship between some health habit (like

eating, drinking, smoking, or exercise) and a health outcome (like gaining weight, becoming ill, getting pimples). Their hypotheses should be reasonable and based on their knowledge of health, and should be stated in a way that can be tested. Have them also develop one or two competing hypotheses they can turn to in case their first hypothesis turns out to be wrong.

Procedure for Day Two

1. Yesterday the class followed along as Dr. Daniels tested her hypotheses concerning the strange illness on the cruise ship. Dr. Daniels is an epidemiologist. Epidemiologists are scientists who look for patterns of illness and health in groups of people. (The word "epidemiology" literally means "the study of epidemics.") Epidemiologists usually base their analyses on observations. They usually do not intervene in the lives of the people they observe, although suggestions for change may emerge as a result of their studies (for example, the suggestion to stop putting cherries in the drinks).

Explain that there are basically two kinds of research studies. In one kind, scientists observe and carefully analyze what they see. Within their experiments, they do not intervene in any way with their subjects (people or things being studied). In the second kind, scientists actually do something to or change something about the people or things they are studying. Studies in which scientists do or change something are called intervention studies—in that scientists are able to do something and then measure the effects of what they have done.

Tell students that today we are going to discuss an intervention study. The researchers who conducted this study did intervene in the lives of their subjects.

2. Distribute "Exercise and Heart Disease: An Animal Study" and allow students time to read it. Then conduct a class discussion focusing on the following questions.

- In this article no hypothesis is directly stated. What is the hypothesis?

(Monkeys that exercise have less clogging of the arteries than monkeys that do not exercise. Note: The hypothesis concerns monkeys, not people. Emphasize this point, and make sure students recognize that uninformed readers could be misled by the lead sentence in this article. The research here is on animals; associations may or may not hold for humans.)

- What is the purpose of having two groups in this study?

(Two groups were used to compare the effects of exercise and no exercise on clogging of the arteries. In this study, exercise is the factor researchers wanted to study. They wanted to know whether exercise is better for the heart than no exercise. Everything else in the environment, including food, was identical for both groups of monkeys. Since the amount of exercise was the only factor that differed for the two groups, it can be assumed that exercise is the cause of any significant difference in the amount of arterial clogging found in each group.)

- Why did the researchers do the study on monkeys instead of people? After all, the researchers were really interested in how exercise affects people, not monkeys.

(The main reason this study could not be done with people is that it is not appropriate for scientists to put people in an isolated environment, feed them on a potentially dangerous diet, and make half of them exercise on a treadmill. Many studies are done on animals instead of people for ethical reasons. One of the basic ethical principles of research is that scientists do not put people into experimental extremes that could endanger their lives or well-being, even if that would be the most "efficient" research method.

In order to protect the rights of people who agree to participate in experiments, researchers must have their experiments approved by a committee that makes sure the experiment is safe. To further protect the rights of people who participate in experiments, researchers must tell their "subjects" about any risks that may be involved. If the person feels the risk is too high, he or she may refuse to participate.)

- Is there enough evidence to agree or disagree with the conclusions of this study? Have the class discuss this question, and also the question of whether we can get useful information on human health from a study done on monkeys. Note that the monkey study, combined with the epidemiological evidence summarized in the first paragraph of the report, builds a stronger case than either study by itself.

3. Summarize: The monkey study is an intervention study, because the researchers could control how much exercise the monkeys received. They could vary the amount of exercise for the two groups and then examine the effect of this variation on arterial clogging. Intervention studies are an important way of testing hypotheses.

Sometimes it is not practical, appropriate, or ethical to do intervention studies. For example, Dr. Daniels could not test the hypothesis that "eating maraschino cherries causes food poisoning" by asking one group of people to eat the cherries in their drinks and another group not to eat the cherries. It would be too dangerous. Given the risks of an intervention study, Dr. Daniels did an observation study. She did not manipulate or change anything; instead she studied the real-life patterns of behavior that might be associated with the illness. Both observation studies and intervention studies are important scientific methods used by health researchers.* In the next part of this lesson, students will have a chance to design their own study, using either method, to test their own hypotheses about health.

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*It is important to note that observation studies cannot prove a hypothesis right or wrong. Observation studies observe correlations or association between factors. Two things correlate when the numerical value assigned to one increases or decreases in relation to the numerical value assigned to the other. A positive correlation exists when the numerical values of two things change in the same direction. For example, usually there is a positive correlation between height and weight: as height increases, weight increases and vice versa. A negative correlation exists when the numerical values of two things change in opposite directions. For example, the more insulation a house has, the less the heating bill will be.

Correlations do not necessarily prove that one thing causes the other. For example, increased weight does not cause increased height. Only intervention studies with positive results can prove a hypothesis correct. However, observation studies can lend evidence to support or refute hypotheses; they can identify issues for further exploration in intervention studies; they are useful in cases where intervention studies are inappropriate or ill-advised.

One way to understand types of research studies is by using the following matrix:

	People	Animals	Building Blocks of Life*
Studies in which researchers observe			
Studies in which researchers intervene			

For example:

	People	Animals	Building Blocks of Life
Studies in which researchers observe	Dr. Daniels' study on the cruise ship	Studies that observe mating behavior, offspring care, migration, hibernation, etc.	Studies that observe splitting of chromosomes as in cell growth and division; studies that observe interaction of naturally-occurring body chemicals, such as enzymes.
Studies in which researchers intervene	Studies that test the effects of medicines or other drugs on human beings.	The Monkey Study	Recombinant DNA studies.

For the sake of clarity, we have only discussed two broad categories; observation and intervention. As the diagram makes clear, either kind of study can be performed on people, animals, or on a basic biological level.

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*Building blocks of life include, for example: biochemicals, molecules, genes, tissues, and organs.

4. Divide the class into groups of three or four. Have each group select one hypothesis from the ones students developed for homework. List these on the board, one for each group. Ask each group to imagine that it is a well-known team of researchers. Using their own best judgment, knowledge of health, and glossary and guidelines which you are about to distribute, members of the group are going to design a study to test their hypothesis.

5. Distribute the "Glossary of Health Research Terms" and discuss any terms the students may have questions about.

6. Distribute "Guidelines for Hypothesis Testing." Go over the guidelines, and then give each group ten or fifteen minutes to come up with a study design. Ask one person in each group to be the recorder, and announce that the groups will share their designs with the whole class when they finish.

Explain that a study design is a plan for testing a hypothesis. It includes information about:

- subjects for the study (what kind? how many? what groupings?).
- the kinds of evidence (data) to be collected.
- how the evidence (data) will be collected.
- how the evidence (data) will be analyzed and evaluated.

As a study design is developed, researchers repeatedly check to make sure the study will be structured to test the hypothesis as directly as possible (by eliminating or controlling other variables as much as possible). As in other professions, researchers need to also be concerned about cost effectiveness in their designs.

7. Ask each group to describe their study designs to the rest of the class. (There may not be time for every group to do this. If not, have them post their designs on a bulletin board.) Focus on the last question in the Guidelines, asking students what kind of evidence they would need to have to feel fairly confident about their results.

8. Ask students to apply the glossary terms to the study designs they have just heard about. Can they state the hypothesis? Identify competing hypotheses? Determine whether it was an observation or intervention study? If intervention, can they identify the experimental group and the control group? If observational, were the researchers expecting any correlations? If so, of what? Who was in the sample?

9. Finally, conclude the lesson with the following mini-lecture.

HOW CAN I BE SURE?

Usually, evidence from studies is not 100 percent convincing. Scientists try to build their evidence in these ways:

- By repeating, or replicating, a study. If a study shows results with one group of subjects, and then is repeated and the same results are found with a second group of subjects, we can have more confidence in the findings.

- By showing that the findings of a study are very strong. For example, in the monkey and exercise study, if the researchers found that all of the monkeys that got no exercise died of heart attacks after one year, while none of the monkeys that exercised had any heart problems, we'd feel fairly confident of the results. Scientists have developed statistical ways of showing the strength of the findings from a particular study.

- By using different methods or different types of studies to test a hypothesis and still coming up with the same findings. For example, Dr. Daniels might have gone beyond her epidemiological findings and had the cherries tested in an experiment with mice, feeding cherries to half the mice, but not the other half. If the mice that were fed cherries got food poisoning, this evidence, combined with the pattern she discovered among the people on the boat, strongly indicates that the cherries caused the food poisoning.

8. Homework: Remind students to keep track of health decisions in their Health Decision Logs. In addition, they should continue to collect health research news items and jot down information from radio or television news reports.

At this point, you might suggest that students start to ask themselves whether any of the information they have collected has affected their thinking about health decisions. They should jot down their thoughts about that question in their logs for that day.

EXERCISE AND HEART DISEASE: AN ANIMAL STUDY*

A recent study conducted at a major university medical center shows that moderate exercise a few times a week may protect against heart disease. For a long time, epidemiologists (people who study patterns of illness and health in groups of people) have noted that there is a relationship between exercise and heart disease: people who exercise regularly seem to have fewer heart attacks and strokes than people who do not exercise. But critics suggested a competing hypothesis: that people who exercise are healthier to begin with and therefore less likely to have heart problems.

The new three-year study was done with Macaque monkeys, which can be induced to have some of the same heart problems as people. The sample of monkeys was divided into two groups. The monkeys in the experimental group ate a high-cholesterol diet for two years, and they also ran regularly on a treadmill. Those in the control group also ate a diet rich in cholesterol for two years, but got no exercise.

The doctors found that the monkeys that exercised had far less clogging of the arteries than the monkeys that did not exercise. In fact, when the researchers examined a major heart artery, they found that it was 60 percent covered with build-up of hardened fat in monkeys that did not exercise, as opposed to a 15 percent build-up in the arteries of monkeys that did exercise.

In other studies, scientists have established that people whose arteries are clogged in this way are at greater risk of heart disease. This is because the excess build-up along the walls of the arteries can block the flow of blood. If the blockage occurs in an artery leading to the heart, a heart attack occurs. If the blockage is in an artery to the brain, the result is a stroke. Because this experiment shows that exercise may reduce arterial clogging in monkeys (which are similar to people in many respects), researchers will be doing further investigations to see if exercise can reduce arterial clogging in people and therefore help prevent heart disease.

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*This case study is fictitious; it is, however, based on a real study.

GUIDELINES FOR HYPOTHESIS TESTING

1. First, examine your hypothesis. Is it testable? (You could not test the hypothesis that acne is caused by evil spirits, for example, because there is no way of measuring the presence or absence of evil spirits. If, however, you guessed that acne is caused by eating a lot of potato chips, you could test your hypothesis by observing what happens when one group of people eats lots of chips and another group of people with similar characteristics eats none.)

2. If your hypothesis is not testable, rewrite it so that you can test it. Be sure to write it so that it applies to a group of people, rather than to one individual. (For example, "Teenagers who eat potato chips get acne," rather than, "I get acne when I eat potato chips.")

3. Decide on the best method to test your hypothesis. Will you do an experiment with people or with animals? Will it be an observation or an intervention study? If you decide to do a study with people, what precautions will you take to protect their rights?

4. How will you get the evidence or collect the data? Explain the steps you will go through. (For example, "We'll have half the people in English class eat two three-ounce bags of potato chips each night for a week, the other half won't be allowed to eat any for the same time period.")

5. If you test your hypothesis through an intervention study, decide who will be in the experimental group and who will be in the control group. For example, how would you make sure that all the acne-prone people don't end up in the potato chip eating group? It is best to make this a random decision, rather than letting people volunteer to join one group or the other or leaving it to the scientist. To randomly assign people to groups, you could have the class count off by twos, with the "ones" asked to eat chips and the "twos" not allowed to eat chips. Other methods of randomizing include flipping coins or alphabetical assignment.

6. What kind of evidence will you need to confirm or refute your hypothesis? (In the acne example, you would probably need photographs of the potato chip eaters and the non-chip eaters.)

7. What findings would you need to feel fairly confident that your hypothesis was right? (If at the end of one week, our teacher can sort the photographs of people in English class into potato chip eaters and non-chip eaters and get 70 percent or more of them correct.)

8. Is there any reason to believe that there was something wrong with your study design? Don't forget: A negative result does not necessarily mean that your hypothesis was wrong. Take another look at your experiment and see if it really did test what you wanted it to test.

GLOSSARY OF HEALTH RESEARCH TERMS

Competing hypothesis: An alternative explanation; it also must be testable.

Control group: The group in a research study that receives no intervention and is used for comparison with the group that does.

Correlation: An association or relationship between two factors. The fact that two things correlate does not prove that there is a cause-effect relationship between them.

Epidemiology: The study of patterns of health and disease in groups of people.

Experimental group: The group in a research study that receives an intervention.

Hypothesis: An explanation that can be tested.

Intervention study: Testing a hypothesis by treating one group (experimental group) in a specified manner and comparing this group with an untreated group (control group).

Observation study: Testing a hypothesis by carefully observing, recording, and analyzing information about a group of subjects. Observation studies cannot prove a hypothesis right or wrong, but they can lend evidence.

Random assignment: A nonbiased way of determining who will be in the experimental group and who will be in the control group. With random assignment, each subject has an equal chance of being assigned to one group or the other. This eliminates the possibility that the scientist will be biased in the way he or she assigns subjects to each group.

Replicability: The ability to repeat an experiment or study using the same methods and get the same or similar results.

Sample: That representative part of a group that is studied to gain information about the whole group.

Subjects: The people, animals, or organisms actually being studied.

Activity Four

Research Provides Guidelines, Not Guarantees

Objectives

Cognitive: Students will:

- Understand why research can provide guidelines for healthful living but not offer guarantees about health outcomes for particular individuals.
- Be able to define "risk factors."

Affective: Students will:

- Gain an appreciation of the role that health research can play in our lives.
- Be less likely to be confused by personal or anecdotal information that seems to negate legitimate health findings.

Activity at a Glance

Students learn to define "risk factors" and participate in a game that demonstrates how risk factors affect a person's chances of developing illness or maintaining health.

Preparation

1. Make one copy of "Risk Factors and Healthful Habits," and cut up the sheets into squares. If you have time and wish to increase the durability of the pieces, you could mount them on cardboard so that they resemble a deck of cards. (Note: There is an equal number of risk factors and healthful habits on these pages: 15 of each. If your class is smaller than 30, you may omit some cards, but be sure you omit the same number of risk factors and healthful habits. The numbers for both must stay equal.)

2. You will need a set of red "chips" and a set of white ones. The number of each should be equal to one-half your class plus ten. (If there are 30 students in your class, you will need 25 red and 25 white chips. If there is an odd number of students in your class, you may want to join the activity as a participant.) The chips can simply be circular pieces of paper, or they can be reinforced with cardboard. Color half the blank ones red and leave the other half white, or ask students to do this at the start of the game. (We have included a sheet with circles at the end of this activity for your convenience.)

3. Finally, you will need two transparent plastic bags. Medium-size food storage bags should be adequate.

4. Duplicate "Accumulating Risk Factors: Stacking The Odds Against Yourself," one for each student. This is assigned as homework and can be shared with parents if you feel that sharing is appropriate.

5. Read the teacher background information that follows.

TEACHER BACKGROUND INFORMATION

The last lesson helped students explore how research studies can lead to useful health recommendations. We know that when different researchers repeat the same study and get the same results or when different kinds of studies (intervention and observation) produce similar conclusions, the credibility of the researchers' findings increases. But even when we have confidence in the study findings—even when the study is relatively noncontroversial—there may be individual cases where the findings simply do not apply. Take smoking, for example. All of us know people who have lived to a ripe old age despite the fact that they have been heavy smokers nearly all their lives. How can we be expected to believe the findings on the dangers of smoking when we all know people whose very existence seems to challenge the research?

In fact, smoking does greatly increase a person's chances of getting heart disease, emphysema, lung cancer, and various other forms of cancer. However, this does not mean that everyone who smokes will get these diseases. It also does not mean that everyone who refrains from smoking will be spared. Research can point out general trends, and it can identify key factors that seem to increase health risks, but it cannot predict exactly what will happen to any one individual.

In this activity, students learn why it is that research can provide guidelines but not offer guarantees.

Procedure

1. Remind students that they have just been learning how to evaluate health research. Summarize the main points of the last activity—that we can more confidently believe in the validity of health research when some of these conditions are met:

- Different researchers have repeated the same experiment and gotten similar results (replicability).
- Different kinds of studies (such as experiments with animals and epidemiological studies that observe patterns of illness and health in human populations) point to similar conclusions.
- The findings seem to be statistically strong (that is, when the findings could not have been the result of chance).

2. Next, propose the following:

> When studies meet these conditions, we can increase our trust in their findings. Research really can contribute to our understanding of health and illness. It can provide us with some useful guidelines. Well, then, if that is the case, how can you account for a man who has been a cigarette smoker since he was 16 years old, has been seriously overweight most of his life, and has just celebrated his ninetieth birthday?

Ask students why it is that smoking is bad for health, when in fact they may know people who fit this man's description.

Solicit students' ideas and quickly put them on the board. Then explain that research can provide us with guidelines but it cannot offer us guarantees. For example, the research that shows that smoking is dangerous is valid; smoking really does increase a person's chance of getting heart disease, emphysema, lung cancer, and various other forms of cancer. At the same time, research cannot predict the health outcomes for any particular individual.

3. Put the term "risk factor" up on the board and define it this way: A risk factor is a habit, trait, or condition associated with an increase in our risk of developing a disease.

Researchers have identified several risk factors for today's major killers. They know, for example, that cigarette smoking is a risk factor for heart disease and emphysema. They believe that cholesterol levels (influenced by eating foods high in cholesterol and saturated fats) and high blood pressure (influenced by salt intake in many people) are risk factors for heart disease. Obesity is a risk factor for diabetes and high blood pressure. Breathing heavily polluted air, especially if you smoke, is a risk factor for lung cancer and emphysema. Any one of these things is considered a risk factor because studies that have compared people who have these risk factors with people who do not show that the prevalence of the associated disease is higher for the group with the risk factor. For example, one set of studies demonstrated that for males age 45 to 64, smokers died from heart and circulatory disease at twice the rate of nonsmokers. This doesn't mean that all men in that age range who smoke will die of that disease, but one who smokes has a much greater risk.

One reason that scientists cannot predict exactly which individuals will or will not develop heart disease is that many factors contribute to the disease. Smoking is one risk factor. Heredity also plays a role; a person whose close relatives have had heart disease runs a higher risk of developing it. And there are many other risk factors that affect the chances of developing heart disease, including age, gender, blood pressure, and cholesterol level. Nevertheless, smoking is a very important risk factor, and not smoking greatly reduces the chances of developing heart and lung diseases. In fact, of all the risk factors, it is probably the one over which individuals have the most control.

4. Ask students to name some other known risk factors and other personal examples, like the ninety-year-old smoker, that on the surface of things might seem to contradict the research. Here are some examples:

> Obesity is a known risk factor for diabetes, yet Mrs. Simon who is 75 now and showing no sign of the disease, has been 30 pounds overweight for 40 years.

> Regular exercise may lower a person's resting pulse rate and cholesterol levels, both of which reduce the chances of heart attacks and stroke. Miranda has never exercised a day in her life, yet she just learned that she has the lowest resting pulse rate in her class.
>
> Pregnant women who smoke cigarettes run a higher risk than nonsmokers of having low-weight babies with possible learning disabilities and other side effects. Frances smokes a pack a day and did so throughout most of her pregnancy. Her baby weighed eight pounds at birth.
>
> Jack was a star athlete on his high school track team, and he has been getting regular exercise ever since he graduated. Just last week, at the age of 27, he suffered a heart attack.

Emphasize that research can provide us with recommendations to help us hedge our bets, but it cannot determine who will or will not get sick. Tell students that in this activity they will discover why this is the case.

5. Explain to students that they are about to play a game in which they will learn more about risk factors. They will have the opportunity to see how risk factors can increase the chances of developing certain diseases, and how adopting healthful practices (like getting regular exercise or not smoking) can reduce those chances.

6. Draw an imaginary line down the middle of the class. In front of each half, ask a student to hold up a transparent plastic bag. Place five red chips, representing illness, and five white chips, representing health, in each bag. Point out that a person drawing a chip at random from either bag would have a 50-50 chance of drawing a red (illness) or a white (health) chip.

Ask students to imagine that these are the chances of a person's developing a disease or staying healthy under neutral conditions—that is, in the absence of any risk factors or positive health behaviors. But in the real world, there are no such things as neutral conditions. Everyone does things or is subject to environmental factors that either increase or decrease the risk of developing disease. In the course of the game students will have the opportunity to measure how the accumulation of risk factors can increase their risk of disease and, conversely, how the accumulation of healthful habits can increase their chances of staying healthy.

7. Beginning at one end of the room and moving along in turn, [illegible] student to come forward and draw a card from the deck

you constructed prior to class. Explain that they will either draw a risk factor or a healthful habit. Ask them to read the card aloud. If a risk factor is drawn, the student should take a seat on the left side of the class and place a red chip in the bag in front of that section. If a healthful habit is drawn, the student should take a seat in the right-hand section of the class and place a white chip in the plastic in front of that section.

8. By the time everyone has drawn a card, the room should be organized into people with risk factors (on the left) and people with healthful habits (on the right). The bags with chips should be in front of their respective groups.

9. Ask for ten volunteers from each group. In turn and with their eyes closed, each volunteer will draw a chip from the bag that belongs to their group. The aim, of course, is to draw a white chip, which stands for health.

Before starting, each group should select a scorekeeper. The scorekeeper will record the name of each person who draws a chip and its color. After everyone has drawn, the scorekeeper will tally the total number of "healthy" white and "unhealthy" red chips for each group.

It should be immediately obvious that the group with many risk factors is much more likely to draw "unhealthy" red chips than is the group with many healthful habits. The scorekeeper's tally will demonstrate this.

Note that the game may need to be repeated. Probability is based on repetition of events. It is possible for students to draw more of the less likely chips than would be expected if only one round is played. Be sure to have a second and third round of drawings if this happens.

10. While the total number of red (illness) chips will be higher for the group that has accumulated risk factors, it is likely that some people from that group did draw white (health) chips. This is exactly what happens in real life. Some people, even with a lot of risk factors--like the ninety-year old smoker, described earlier--manage never to develop the diseases for which they apparently should be at greater risk. Emphasize that the reason is not that they are luckier, but that other factors, such as inherited traits, may have offset the effects of the risk factors.

Students should also notice that in the right-hand group, with a lot of healthful habits, there are some red chips. Again, this happens in the real world. Even some people who follow all the best advice about healthful habits do develop diseases.

Emphasize that they may have special inherited characteristics that predispose them to the disease, or perhaps they have accumulated risk factors that are as yet unidentified.

The point is that more people in the left-hand group got sick and more people in the right-hand group stayed well. The people who accumulated a lot of risk factors ran a higher risk of developing disease, while the people who followed healthful habits had a better chance of staying healthy. Research cannot guarantee our health; it can provide guidelines or recommendations, which increase our chances for health.

You might also point out that in this game students picked risk factors arbitrarily out of a bag. In real life, certain groups of people tend to have certain risk factors. Executives living in large cities, for example, might have some of the following factors in their "risk bag": emotional stress, noise and air pollution, excessive coffee drinking, high blood pressure. And of course, executives over 50, who smoked, exercised little, and ate high-fat diets would have additional risk factors associated with those behaviors. The diseases for which these executives would be at risk are those that correlate with the factors in their risk bag--especially heart attacks and stroke. A different population with a different "risk bag" would be at risk for a different set of diseases. The "risk bag" for poor, malnourished, pregnant teenagers might include the following risk factors: age, poor nutrition, limited access to prenatal health care. We know that teenagers with this "risk bag" have a higher chance of delivering low birth-weight babies and of suffering complications of pregnancy. They also run certain social health risks such as lower educational and economic opportunities. When you hear about a health research study, think about the group of people studied and the risk factors that were likely to be in their bag. Then ask yourself, "Does this study include my bag? Do I have some of the same risk factors the group under study had?"

11. To summarize the main points of this lesson, distribute "Accumulating Risk Factors: Stacking the Odds Against Yourself" and ask students to read it as homework. If you feel it's appropriate, encourage them to share it with their parents and to tell their parents about the class demonstration on risk factors.

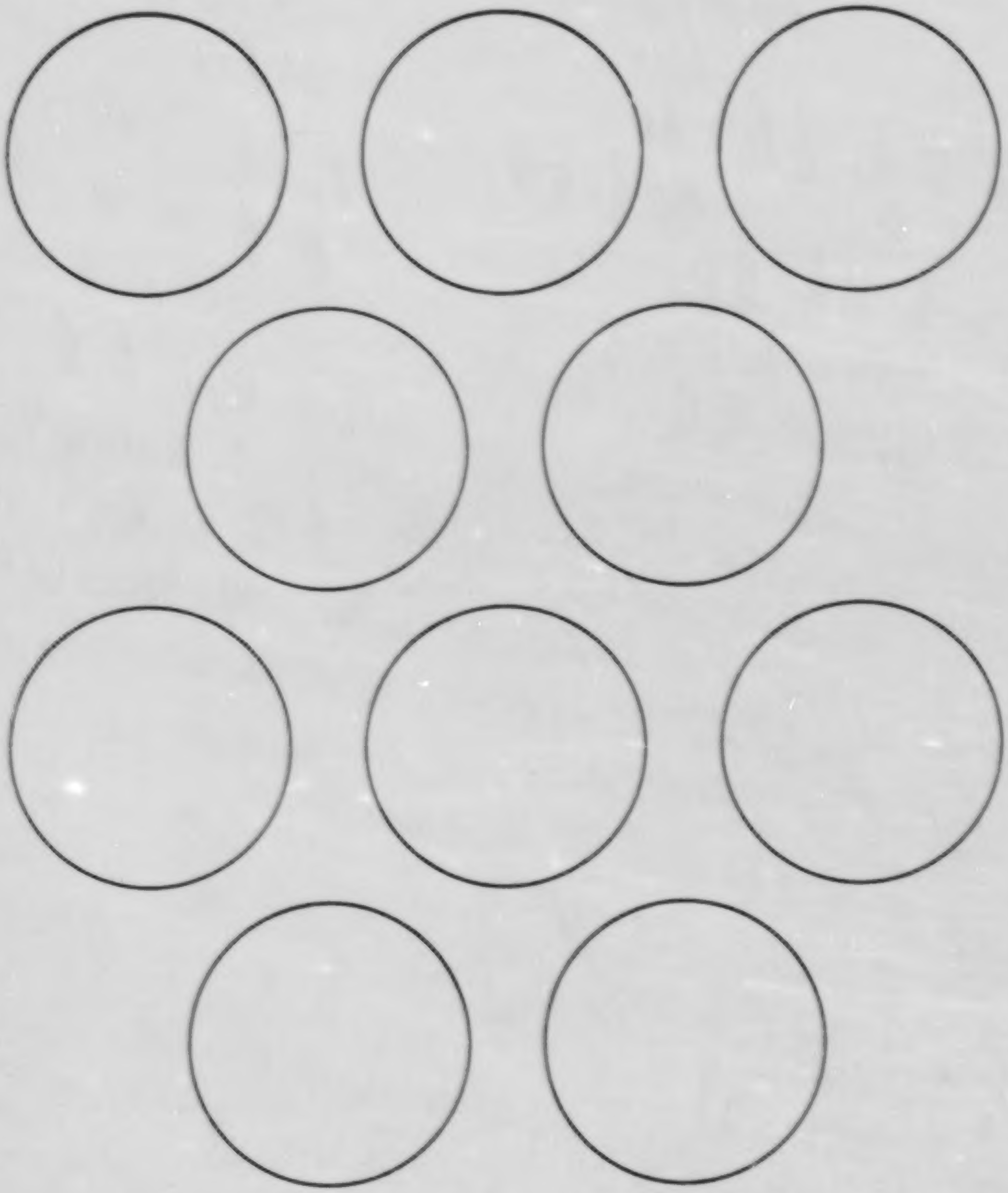
12. Homework: Ask students to continue thinking about and writing down health decisions, influences, and outcomes in their logs. In addition, ask them to try to identify any risk factors associated with the decisions they are keeping track of. Also, if students shared the handout with their parents, have them record in their logs highlights of their family discussion.

RISK FACTORS AND HEALTHFUL HABITS		
You jog a half hour after school four times a week. Add a white chip.	You smoke a pack a day. You are increasing your risk of heart attacks, stroke, emphysema, and lung and bladder cancer. The odds are against you. Add a red chip.	You eat lowfat milk products. You know the importance of cutting down on fats in your diet. Add a white chip.
You wear a helmet when you ride your bike. Add a white chip.	You always wear a seat belt. Add a white chip.	You have cut down on salt. You recognize the association between salt and high blood pressure. Add a white chip.
You eat lots of fresh fruits and vegetables. Add a white chip.	You keep your weight down by watching the amount of sweets you eat. Add a white chip.	You know how to handle stress quite well and usually express your feelings before they get bottled up. Add a white chip for health.
You sometimes drink and drive. Add a red chip.	You eat lots of greasy foods, rich creamy desserts, and other high-fat foods. Your risk of gaining weight and increasing cholesterol levels is high. Add a red chip.	You eat lots of sugary drinks and other sweets. Add a red chip.

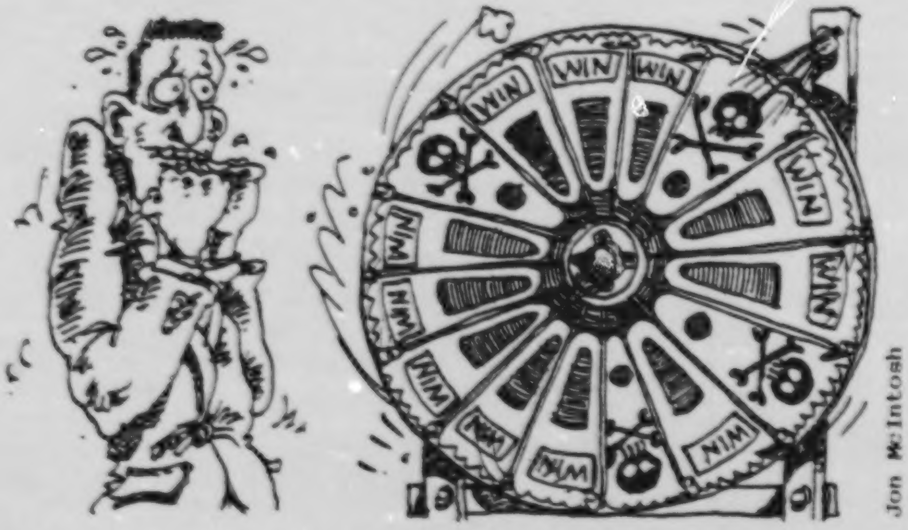
You never wear a seat belt. Add a red chip.	You helped pass a city ordinance against the dumping of toxic wastes in your community. As a result, you have lowered your chances of drinking polluted water. Add a white chip.	You have helped institute car-pooling in your city, so that there is now less traffic and lower levels of carbon monoxide in your city's air. Congratulations! Everyone in your city now has lower risk of lung cancer, emphysema, and other illnesses. Add a white chip.
You rarely wear a bicycle helmet. Add a red chip.	There is a history of heart disease in your family. Add a red chip.	There is a history of diabetes in your family. Add a red chip.
The air in your city is heavily polluted. You run a higher risk of lung cancer, emphysema, and other respiratory illnesses, especially if you smoke. Add a red chip.	You work with toxic chemicals, some of which are thought to cause cancer. Add a red chip.	You never drink alcohol beverages and drive. Add a white chip.
You eat breakfast every morning Add a white chip.	You swim at least three times a week. Add a white chip.	After two years of smoking, you quit and haven't had a cigarette in three years. Add a white chip.

You get very little exercise, which puts you at greater risk of developing high blood pressure and heart disease. Add a red chip.	Your home drinking water is polluted. Add a red chip.	You work with asbestos, which puts you at a high risk of developing asbestosis and possibly lung cancer. Add a red chip.
You are 30 pounds overweight, which puts stress on your heart and also increases your chances of diabetes. Add a red chip.	You are under a lot of stress and strain in your personal life and don't know who to talk to about it. Add a red chip.	You may stay up late once in a while for something special, but, generally, you are careful to get the proper amount of sleep. Add a white chip.

Duplicate this sheet four times. (This will supply enough chips for a class of thirty. If you have more students, add one more chip per student.) Cut out the circles and color half of them red. Leave the other half blank.



ACCUMULATING RISK FACTORS: STACKING THE ODDS AGAINST YOURSELF*



Accumulating a lot of risk factors is like stacking the odds against yourself. The more you accumulate, the less likely it is you'll win.

"What are risk factors and what do they have to do with health?"

A risk factor is a habit, trait, or condition associated with an increase in our risk of developing a disease. The risk factors for today's major killers include poor dietary habits, lack of exercise, obesity, smoking, environmental pollution, and inability to cope with stress. Family history of disease, age and gender can also increase or decrease the risk of developing some diseases. Usually more than one risk factor is associated with a disease.

"There is no history of heart disease or cancer in my family. Aren't I safe?"

Heredity is one risk factor you may not have to worry about. But it is just one of the risk factors that affect your chances of developing these diseases. Scientists have learned that heredity alone does not outweigh the effects of smoking, poor dietary habits, lack of exercise and some of the other key risk factors.

*This material is adapted from the Teenage Health Teaching Module Eating Well.

"My grandfather was fifty pounds overweight, ate what he pleased, smoked two packs a day and lived to be 85 years old. Hey, if he could do it, why can't I?"

Well, you might be able to, but the odds are dead-set against you. Here's how it works. Imagine two groups of people—one with many risk factors and one with very few. Many more people in the first group will develop health problems than will in the second group. That doesn't mean that everyone in the first group will get sick or that no one in the second group will. What it does mean is that people who accumulate a number of risk factors run a much greater risk of disability or premature death.

It's easy to point to someone like your grandfather as "proof" that personal habits don't matter. But we know from experience that they do make a difference.

"I don't understand all this fuss. We've all got to die sometime, don't we?"

Sure, we all have to die sometime, but there are two important questions worth asking: what kind of quality of life do you want to create for yourself, and how long will you live?

Remember that heart attacks and strokes don't always kill. For every person who dies, many more are left severely disabled. This means not being able to do what they want, when they want. It also means dependency on someone else for support and care.

Changing some of your habits can extend your life expectancy, help you look and feel better, and help ensure that you lead fuller, richer, and more active lives in the time you have left before you.

"My family and I are healthy. I don't see what we have to worry about."

The problem with heart disease, diabetes, and cancer is that they are degenerative diseases. Degenerative diseases build up slowly and invisibly over a long period of time. Establishing healthful habits now and maintaining them over the years can stop trouble before it begins.

"One thing after another. Seems like everything's bad for you. If I paid attention to all this, there'd be nothing left to eat."

It may sound that way, but in fact everything isn't bad for you. Because the news media frequently report newly suspected substances, it may appear that the number of carcinogenic chemicals and foodstuffs is very great. But in fact there is really a relatively small number of dangerous compounds. We could eliminate them without really missing out on a lot.

Activity Five

Asking Smart Questions

Objectives

Cognitive: Students will be able to:

- Ask questions to evaluate health research and health research media reports.
- Reassess the role of new health data in personal decision making.

Affective: Students will:

- Become more comfortable in their own ability to interpret and use health research information.

Skills: Students will be able to:

- Better evaluate new health data.

Activity at a Glance

On Day One, students generate a list of critical questions to help them assess an outlandish health claim. Then they evaluate a serious health research report, applying a series of "Smart Questions" in their analysis. On Day Two, students, working in small groups, apply the questions to another health research report. Although we have divided the lesson into procedures for Day One and Day Two, you may find three days necessary.

Preparation

1. For Day One, duplicate the newspaper articles, "For Healthier, Longer Life, Don't Think Too Thin," and "Smart Questions," one of each for each student.

2. For Day Two, duplicate the newspaper article, "Some Fruits, Vegetables...," one for each student.

Procedure for Day One

1. In the last two activities, students learned about risk factors and how research can provide guidelines for adopting health habits that can decrease the risk of developing disease. An understanding of risk factors is crucial to making sense of health research news, but that understanding alone is not enough to interpret and assess health news. In this activity, students move out from an understanding of risk factors to a more general look at health research studies. They are provided with some skills that help them evaluate and interpret the results of health research and health research media reports more critically.

2. One of the things that makes assessing health research so difficult is the large number of reports on many different topics. Here are some typical headlines an average person might see or hear in one day. Read them aloud to the class very quickly or assign each of them to individual students. You might, for example, whisper the headlines to individual students and ask them to repeat their line as fast as they can when you point to them. Orchestrate the piece by quickly pointing at random to the various students.

New Research Uncovers "Safe" Cigarette

Cholesterol O.K.

Cholesterol Not O.K.

New Mood Drug Creates Perfect Happiness

All Drugs Dangerous to Your Health

New Contraceptive Useful to Goats

Passive Smoking Harmful

Passive Smoking: A Lie

Drinking Helpful in Moderation

Drinking Data Still Disputed

Flap Percolates Over Coffee Beans

Coffee Not Harmful

Ask students:

- How can we make good health decisions based on research when the news seems to change daily? When studies are difficult to evaluate? When claims are as outrageous as some of the headlines we just heard?
- How can we tell the difference between conclusions that are well researched and ones that are wildly optimistic?

Explain that they are about to try their hand at evaluating an outlandish health claim to see how skillful they are at assessing health research reports. Note that this example will be fairly easy to evaluate, but that real-life studies used later will require more analysis.

3. Tell students that you are about to take on the role of Dr. X, a health researcher who claims to have made a great discovery. Their job, as they listen to your claim, is to think of what more they would want to know before they would follow your advice.

Stand up in front of the class and say:

> I am Dr. X and my team of researchers has discovered the ultimate cure for acne. Countless people have benefited from our discovery already. People afraid to show their faces before now have skin like a baby's. Our conclusions show perfect results with honey and bran. If you eat my Sweet Mirabran, you'll never have acne again.

(By the way, if students think this claim is utterly ridiculous, ask them to compare it to claims made in magazine, television, and radio advertisements.)

Ask students to brainstorm all the questions they would like to ask of Dr. X in order to evaluate his claims. If questions like the following do not come up, mention them yourself:

Who are you, Dr. X?

Where was your research done?

What do you mean by "the ultimate cure?"

How many people did you study?

Did a bran or honey company sponsor your research?

Do you stand to gain financially if people follow your advice?

Why do you seem to be selling the cure?

What do other acne specialists think of your report?

How many times have you done this research?

Have other researchers ever done similar studies?

How did you get people to eat large amounts of honey and bran?

Did the people who ate large amounts of honey and bran have any side—effects?

In Dr. X's case, it was clear that he was making a wildly optimistic claim about a product whose sale was probably going to benefit him financially. Whenever a new research study or a new health claim comes along, it is important to ask who funded the study, and whether they have anything to gain by confirming certain kinds of results. If so, it is important to also search out the opinion of other researchers with less potential for bias.

There are, of course, legitimate scientific controversies among the most reputable, unbiased researchers in the health field. If the scientists themselves do not always agree, how can we be expected to make sense of all this?

4. Distribute "Smart Questions" and explain that these are questions researchers themselves have identified as important for people to ask about health research and health research reports. Go over each of the questions and discuss why it is important to ask it.

5. Next, pass out the newspaper article, "For Healthier, Longer Life, Don't Think Too Thin," and ask students to read it carefully, applying the questions they have just discussed to the report.

In some ways, the last of the "Smart Questions" is the most important question of all: Are the research results reported in this article relevant to one of my personal health decisions? If so, is there enough information to make me consider changing one of my decisions? All the other questions help in answering that big question. To start the discussion of the article, ask students if they think they will change or reconsider any health decisions on the basis of the report. Before they come to a conclusion, encourage them to answer each of the other Smart Questions. Following is a guide to facilitate the discussion.

(1) Is there reason to believe these researchers are competent?

Yes. The researcher comes from a well-known and well-respected university and is the clinical director of a national institute.

(2) Is there reason to believe these researchers are unbiased?

There is nothing in the article that would connect the research team with any individuals or organizations interested in a particular outcome.

(3) Has anyone responded to this piece of health news?

Yes. Researchers from at least two other institutions comment on this issue in the article.

(4) Are there qualifying words in the article that are signals for caution in interpreting the results?

The newspaper article itself does not contain many qualifying words. In fact, the headline is very misleading by implying that there is no controversy surrounding this question, when in fact there is controversy. If you just read the headline and the first few paragraphs, you might think it was granting medical permission to gain weight or that thinness might guarantee a longer life. Careful reading of the article shows that those conclusions are unwarranted.

Most responsible researchers present their conclusions in tentative language. Be leery of researchers or news reporters who overstate claims or jump to hasty conclusions.

Later in the article, the careful reader does find some cautionary words: "May be flat wrong...." "May be the ones who die sooner...." "According to some studies...."

(5) What kind of research was done?

A survey and analysis of several epidemiological studies. This was an observation study.

(6) Has the study been replicated (done over and over)? Have the results been similar?

No, the study has not been replicated; however, some other studies appear to support its results.

(7) Did the subjects under study have particular characteristics that might limit the usefulness of the results? How widely can the results be applied?

One of the weaknesses of this report is that it doesn't tell us much about the sample of people who were studied.

(8) Are there other factors, not examined in this study, that might have influenced the results? What are they?

Yes, researchers report that being overweight can be very dangerous for people with high blood pressure or diabetes or with a history of these diseases in their family. So the study findings are relevant for some people but not for others.

(9) Does the article report on all that is known about the topic? Has important information been left out?

The article only reports on research that seems to confirm the researchers' findings. In fact, there is controversy about "ideal" weight, which is not mentioned in this article.

(10) What health questions have been answered for you?

This article doesn't really answer many questions. It is too soon to feel confident about its conclusions. Even the researchers want to see more studies done.

However, the article does point out that "ideal weight" may be higher than previously agreed upon. Family history and other health factors (like high blood pressure) should be taken into consideration. The article also gives further evidence against being very thin, which is relevant to teenage preoccupations with body images and interests in fad diets. Students can expect to see more on this topic.

(11) What new questions have been raised in your mind? What new questions have been raised for future research studies?

Why do higher weights seem to result in longer life for some people? One reason the researcher offered was that additional weight may improve a person's chance of withstanding chemotherapy for cancer. What do you think of this as a rationale for raising standards of "ideal" weight? What is "ideal" weight?

(12) Is the topic part of an ongoing controversy? If so, which side of the controversy has been given added weight by the results of this study?

Yes. Although not conclusive, the article supports the idea that thinness is not necessarily equated with longevity.

(13) Are the research results reported in this article relevant to one of your personal health decisions? If so, is there enough information to make you consider changing one of your decisions? Do you need additional information? Where could you get it?

To see if the findings might have relevance for you, you might want to find out if there is a history of diabetes or high blood pressure in your family. If you believe you are underweight or overweight you could check with the school nurse or a doctor.

(Students should be able to see that there really is not enough information on which to base a decision. At the same time, eating habits and weight management are topics of continuing concern throughout life. Review sources of information on these issues.)

In conclusion, point out that the article illustrates one of the basic premises in science: that health messages can change over time. As scientists learn more, they revise and refine their earlier conclusions.

Another important scientific perspective is dramatically illustrated by the weight issue: that legitimate scientific controversies do exist, and rigorous debate is an important part of health research.

Procedure for Day Two

1. Distribute copies of "Some Fruits, Vegetables..." and ask students to read the article carefully.

2. Divide students into groups of three or four. Ask them to imagine that they have heard someone in the halls at school say:

> I heard this report on television and they said it's okay to smoke so long as you eat plenty of carrots.

Tell students this is an obvious misrepresentation of the research report they just read, but, like other misinterpretations of swift news reports, it is a mistake that many people might make. In their small groups, their job is to make up a reply to the imaginary comment. They should refer to the list of "Smart Questions" to help them build their cases.

3. Allow about twenty minutes, then ask the groups to report back to the rest of the class. If they have referred to "Smart Questions," they should mention some of the following things, but don't expect them to have covered it all.

Question	To Think About for the Answer
Is there reason to believe these researchers are competent?	They are connected with reputable institutions.
Is there reason to believe they are unbiased?	They seem to have no vested interest.
Has anyone else responded?	Not much response yet. One scientist warns against too much Vitamin A.
Are there qualifying words?	All through it: "Still not sure...," "Seem to curb...," "Might help."
What kind of study?	Epidemiological.
Has it been replicated?	No. Scientists acknowledge need for more studies.
Particular characteristics?	Only men. Does not mention disease history of men in sample.
Other factors?	Did the Western Electric men exercise on the job? Have regular check-ups? Were there different findings for heavy versus light smokers?

Question	To Think About for the Answer
Does it report all that is known?	This report does not mention that other scientists have said that this study in no way should be taken to mean that high intake of Vitamin A makes smoking safe.
What has been answered?	The article does not provide positive or certain answers, but it does point out a possible link. Students can expect to see more research reports.
What new questions?	What is the role of retinol as opposed to carotene? What is the potential mechanism for a protective role? What other factors are associated with diets high in Vitamin A?
Ongoing controversy?	There is no controversy about the dangers of smoking; many comprehensive studies have confirmed the dangers. There is now some question about the ability of carotene to decrease smokers' risks, but even with carotene-rich diets smokers may still suffer higher risks than nonsmokers.

After each group has presented its "answer," ask these questions of the entire class:

- Would you need additional information before reconsidering any of your own health decisions?

There is not enough information here for anyone to base a health decision on.

- Are the results reported here relevant to a health decision you might make?

This study in no way alters the fact that cigarette smokers run higher disease risks. What it does say is that until more research can be done, "it seems prudent" to include carotene-rich foods in daily diets. The article cautions against high Vitamin A levels from pills. It is possible that smokers might be able to reduce their higher risks if they ate carotene-rich diets, but it is not clear whether these lower risks (if they could be achieved) would reduce smokers' risks to nonsmoking levels. Nonsmoking students should stick to their decision and smokers should realize that smoking continues to put them at higher risk.

Point out that another very important perspective is highlighted by this article: health questions take a long time to investigate. This issue is far from being settled.

Finally, tell the whole class that in another article the principal researcher stated that the findings should in no way be considered an endorsement of smoking. Ask:

- Should this have been included in this article? Why or why not? Is the reporter being fair in not reporting this crucial advice?

Optional Activities and Student Assessment Ideas: Ask students to find another health research article and evaluate it using the Smart Questions. We have supplied some additional articles (and suggested answers to the Smart Questions for each one) in the Appendix. Students could be asked to answer the Smart Questions for each article. Then their answers could be compared with the ones we have supplied.

If students bring in and analyze their own articles, a class file could be maintained.

Homework: Students should continue their health logs, which will be shared in the next activity. Ask them to pay special attention to patterns of "Influences" and "Outcomes" so that they can share information with the whole class.

SMART QUESTIONS

(1) Is there reason to believe these researchers are competent? (What are their qualifications and institutional connections?)

(2) Is there reason to believe these researchers are unbiased? (Was the research sponsored by a company, group, or individual who would benefit financially from the research results?)

(3) Has anyone responded to this piece of health news? (Have other experts, individuals, or organizations commented? Would any of these people be financially affected by the research results?)

(4) Are there qualifying words in the article (like "may," "seem," "possibly," "appears," "in some cases") that are signals for caution in interpreting the results?

(5) What kind of research was done? (Observation study? Intervention study? With people, animals, or "building blocks of life"?)

(6) Has the study been replicated (done over and over)? Have the results been similar?

(7) Did the subjects under study have particular characteristics that might limit the usefulness of the results? How widely can the results be applied?

(8) Are there other factors, not examined in this study, that might have influenced the results? What are they?

(9) Does the article report all that is known about the topic? Has important information been left out?

(10) What health questions have been answered for you?

(11) What new questions have been raised in your mind? What new questions have been raised for future research studies?

(12) Is this topic part of an ongoing controversy? If so, which side of the controversy has been given added weight by the results of this study?

(13) Are the research results reported in this article relevant to one of your personal health decisions? If so, is there enough information to make you consider changing one of your decisions? Do you need additional information? Where could you get it?

For Healthier, Longer Life, Don't Think Too Thin

By Philip J. Hilts
Washington Post Staff Writer

The "desirable weight" charts in doctor's offices all over the country are about to be revised--possibly pushing desirable weights up by 15 pounds--and if we want to live longer, we all should revise our ideas about fat and health, according to Dr. Reubin Andres, a professor at Johns Hopkins and clinical director of the National Institute on Aging.

Popular belief says that thin people live longer and fat people will be brought down sooner by their weight. But that belief, though it is hawked by scores of diet books, and even doctors, may be flat wrong. In fact, skinny people may be the ones who die sooner, according to some studies reviewed by Andres.

Andres, whose field is obesity and aging, has reviewed more than 40 studies of weight and longevity, covering some 6 million people. The studies ranged from Helsinki policemen and Italian villagers to 750,000 Americans by the American Cancer Society and 5 million people by American insurance companies.

The populations were extremely diverse, but what's important is that the results all point in the same direction--the desirable weight if you want to live longer has been underestimated. The current chart on doctor's walls, and our own ideas of desirable weight fixed by a sense of esthetics, are not desirable if you want to live longer," Dr. Andres said.

Among the surprises in studies that Andres looked at were these:

- Highest longevity among middle-aged workers at a Chicago utility company occurred in men who were 25 to 32 percent over their "desirable" weight.
- There was minimal mortality among 70-year-old Californians who were 10 to 20 percent "overweight."
- Lowest mortality among San Francisco longshoremen was found in the group that was 30 percent overweight.

In a long-term study of residents of Framingham, Mass., men in similar age groups were found with lowest mortality toward the heaviest end of the scale. Among women in the same town, longevity was greatest in a broad range of middle weights--including some previously thought to be overweight--and mortality highest among the very thinnest and fattest women.

Andres offers two explanations for longer life at somewhat higher weights: heavier people can better tolerate chemotherapy for cancer, and their extra weight may also help them fight diseases that leave others emaciated.

The basic chart American doctors and dieters have used for the past two decades was created by Metropolitan Life Insurance Co., based on surveys of weight and longevity by many insurance companies. But now out of a large new insurance survey is coming a new chart.

This chart is expected to add 15 pounds to desirable weights, and Andres says his data indicate that the shift should be even greater--perhaps as much as 10 to 20 percent of body weight.

Andres is 5 feet 10 and weighs 178 pounds; the "desirable" weight for him would be 154 by the old chart.

There is no single desirable weight, of course, and extremes of obesity and thinness are both dangerous to health, Andres said. "But the question is, if you want to live longer, where do you put that middle range of weight? Most of us go by esthetics because we just don't like the look of fat people. But the best esthetic weight may not be what is desirable if you want to live longer."

Another researcher has confirming evidence of the Andres survey. Dr. Ancel Keys, developer of the K-ration and now professor emeritus of physiology at the University of Minnesota, has taken statistics on more than 12,000 men in the United States, Japan, and Europe for the past two decades.

He has found that "in the absence of hypertension [high blood pressure], overweight is not a risk factor at all."

A recent article in Johns Hopkins Magazine surveying the new results in weight and health also quotes Dr. David Levitsky, associate professor of psychology and nutrition at Cornell University.

He says that perhaps half the people who are overweight will suffer ill health effects from it, and half will not. "I'm not saying it's okay to be fat. If you are fat, you have to look out for certain pathologies...." But if you don't suffer from any of the obesity-exacerbated diseases, he says, then fat is not necessarily bad and losing weight probably will not gain you a longer life.

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December 27, 1980

Some Fruits, Vegetables Seem to Curb Lung Cancer, a New Study Indicates

By Victor Cohn
Washington Post Staff Writer

A major new study indicates that people—even cigarette smokers—who eat a lot of carrots, peaches, tomatoes, spinach and other deep red, green or yellow fruits and vegetables are less likely than others to get lung cancer.

This relationship has been reported by scientists from four major institutions—Rush-Presbyterian-St. Luke's Medical Center, Chicago; Harvard and Northwestern University Medical Schools and the University of Michigan—in a lead article in the British medical journal, Lancet.

All these foods are high in vitamin A and particularly in carotene, a natural coloring matter that is converted to vitamin A in the body.

A 19-year study of 1,954 Chicago men, all Western Electric Co. employees, found far less lung cancer than expected in men, even smokers, whose diets were high in carotene.

Among cigarette users of 30 years' standing, those who consumed the least carotene had eight times the risk of those who consumed the most carotene, that is, those who consumed more carotene than three quarters of the other smokers.

More studies are needed, the scientists say, to prove whether carotene or any vitamin A intake will reduce lung cancer risk. Meanwhile, they add, "it seems prudent" to include carotene-rich foods in daily diets.

"I'd suggest one or two helpings a day," the study's chief author, Dr. Richard Shekelle of Rush-Presbyterian-St. Luke's, said yesterday. "I've increased my carrot intake," Shekelle, an ex-smoker, added.

Carotene abounds in vividly red, green or yellow fruits and vegetables, Linda Smith of the Community Nutrition Institute in Washington reported. Among others: dark salad greens (like endive, bibb lettuce and collard greens), beets, broccoli, green and yellow squash, sweet potatoes, grapes (especially red grapes), apples (especially in the skin) and persimmons.

But no one, said another scientist, should try to augment vitamin A intake by taking large numbers of vitamin A pills. These contain forms of the chemical that can cause liver damage in excess doses.

The Rush-Presbyterian scientists have been studying the Western Electric employees since the late 1950s. They recently showed that those who ate diets low in fats and cholesterol tended to have less cholesterol buildup in their blood vessels and also less heart disease.

In recent years studies in several countries have seemed to show that persons who consume foods high in vitamin A have less lung cancer. But these foods may be richest in either "pre-formed vitamin A" or retinol, or "pro-vitamin A," the carotene which can become the vitamin in the body.

The Chicago study found no correlation with retinol intake, but a strong correlation with carotene.

Thirty-three of the Western Electric men developed lung cancer over the 19-year observation period. Twenty-five of these 33 ate less than average amounts of carotene; 14 were in the lowest 25 percent for carotene intake.

Though most lung cancer occurs in cigarette smokers, nonsmokers apparently benefited too.

Dr. Michael Sporn of the National Cancer Institute has shown that various vitamin A compounds can prevent cancerous transformation of human and animal cells in the test tube. It's still not sure just which vitamin A or pre-vitamin A compounds might help prevent cancer, he said.

But there is good reason, he said, to test such compounds against a variety of human cancers. And tests in various human populations have recently started or are now being planned.

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Activity Six

Looking Outside for Information; Looking In at Health Logs

Objectives

Cognitive: Students will be able to:

- Cite major resources for gathering more information on health news.
- List the kinds of health-related decisions they have made over time.
- Examine role of health information in decision making.

Affective: Students will:

- Appreciate the long-term effect their decisions have on health.
- Value personal ability to seek more information on health data.
- Recognize that health decisions are influenced by many factors.

Skills: Students will be able to:

- Identify ways to gather health information.
- Analyze factors that most frequently influence health decisions.

Activity at a Glance

By supplying advice to two fictitious teenagers, students practice finding sources for health information. Then they examine their "Health Logs" and discuss long- and short-term effects of the health decisions they have made.

Preparation

1. Make copies, one per student, of "Some National Health Organizations".

2. If you have time for more preparation, you can list some specific local health resources for students to use in thinking about further ways to gather relevant information on health news reports. Finding local health information resources can also be a student project (see Optional Activities, after Step 4 of Procedure).

3. If you have not already done so, clear a bulletin board so that students can put up health news clippings and summaries of radio or television reports for future reference or for research for this activity.

Procedure

1. Emphasize that, in most cases, a single newspaper article or radio or television report does not provide enough information to form the basis of a health decision.

Ask students:

- Where could you find additional information?

Libraries are one place to seek further information. Students can begin by asking the librarian about relevant articles or useful magazines. Family doctors, school nurses, or health care professionals, state and local health agencies and departments of public health, and health education resources are other possibilities. Local chapters of voluntary health organizations, which you can find in the phone book, can be helpful, as well as local chapters of professional medical associations. Hospitals or community health education centers can be called for information, and the telephone yellow pages are useful for finding other categories and resources available in your particular area.

Ask students:

- How would you begin to use the phone book?
- If you wrote for more information on an article what would you ask for? Would you include the article? What would you say in the first paragraph?
- If you called a hospital for more information on the issue of exercise, who would you ask to talk to? What would you say? How would you explain what you want?
- What kinds of resources are available in state and local health departments? How could you find out?

2. Distribute "Some National Health Organizations." Then read the following situations and ask the class to name a few resources each person could use. Explain that many of the national organizations have state or local branches in major cities or large towns, and that students should contact the state or local office before trying the national one. Emphasize that students can use the telephone book to locate the nearest local branch of a national organization. If there is not one in their area, they can write the branch of the organization nearest to their town or city.

John has just read an article about marijuana and lung problems. He tells his friends about it, and they say it's bunk. Where can he get more information?

Melissa wonders about her cousin's habit of drinking two beers a night, because her cousin is three months pregnant. Melissa is concerned because she heard on television that alcohol can be dangerous to the health of the fetus. What can she do to get exact information?

Point out that if they cannot find an exact "match" between the health data situation and a resource, they can think about a national organization whose concern seems closest to whatever information is being sought. Even if it can't help, it can provide a referral to the proper organization.

In addition, mention that the search for relevant information is not always easy. Like scientists, students might have to be detectives, open to new clues, assertive in their searches. If they get stuck, they can go to people who work in libraries or community education centers. Those people are excellent resources themselves, and if they cannot answer some questions they may be able to provide other sources.

Here are some sources of information for the individuals in the "situations."

John can go to the library to ask whether there is any other research being done on marijuana. He can also write to the National Institute for Drug Abuse or the American Lung Association, call his local American Lung Association chapter, or contact the American Council on Marijuana and Other Psychoactive Drugs, Inc.

Melissa can call her local medical association, write or call the local March of Dimes chapter, or ask a physician about where to get further information.

3. Have students look through their Health Decision Logs, and ask for volunteers to describe one decision and one outcome or effect to the whole class.

Ask:

- What long-term effect could that decision have on your health? (Try not to be judgmental. If you reserve your opinion, especially at the beginning of the discussion, students will be more likely to engage one another.)
- Where would you go to get more information about your health decisions? (For instance, a person who decided against jogging on asphalt after hearing a vague report about damage to tendons might look for information in a sports medicine journal, talk with a physical therapist, or ask the school nurse for other sources of information.)

Ask students to look through their Health Decision Logs, especially at the column, "Influences," and to call out some factors that influenced their behavior, like time, family traditions, peer advice, media, etc. Write them on the board. Some others might be the following:

- What Other People Do
- Personal Likes or Dislikes
- Beliefs (about food or sleep or illness, for example)
- Just a Whim (lots of times there are no apparent reasons for choices)

Then ask them to look back through their Health Decision Logs to see if health news has played a role in their decision making. Remind students that studies on adults also apply to them, because they are making decisions now that establish habits, attitudes and even some physical changes which can affect their health later in their lives.

Discussion Questions

- Did new health information play a role? If so, how? If not, is there new information, available in the media, that could have played a role?
- What kinds of attitudes do you now have towards new health information? Do you feel more or less receptive to it now? Give reasons.
- Does anything stand in the way of your using new information?
- What else would you need to know if you came across an interesting piece of health information?
- What is the effect of new information on your behavior?
- After having gone through this module, how do you think new health information can play an increased role in kinds of decisions recorded in your logs?

4. Students can put interesting news clippings and notes from reports heard on radio and television on the bulletin board.

In closing, remind students that the bulletin board will be a place they can refer to for new health information, and where they can continue to contribute examples of health reporting in the media.

Optional Activities

1. Students can pick a controversy, investigate it, invite an expert in for discussion, and later publish the results of their research in the school newspaper. (If students decide to do this project, you need to call the expert some time in advance.)

2. Students can use the "Some National Health Organizations" list, the telephone Yellow Pages, and other materials and contacts to help them research a list of local health information resources. The list would include names, addresses, and phone numbers of organizations, as well as

topics the organizations deal with. This can be a class or committee project, and would give both students and their families a concrete aid for their health decision making.

3. To engage other students, faculty, and parents in wanting to know more about health information resources, you can arrange to have the list of "Some Health National Organizations" printed in the school or PTA newsletter. If students have compiled a local list of health information resources, it should be printed instead of or in addition to the national list.

SOME NATIONAL HEALTH ORGANIZATIONS

The following list is a sampling of national organizations offering health information. It is not intended to be exhaustive, and will hopefully be updated periodically to identify organizations that have been missed or that have produced new resources useful in health education curricula. THOSE SEEKING PUBLICATIONS OR INFORMATION ASSISTANCE FROM THESE ORGANIZATIONS SHOULD ALWAYS DETERMINE IF THERE IS A LOCAL OR STATE AFFILIATE OF THE NATIONAL ORGANIZATION AND CONTACT THE CLOSEST OFFICE FIRST. Addresses and phone numbers can be checked through telephone directories, libraries, and local health agencies. ALSO, HEALTH INFORMATION AND HELP IN IDENTIFYING OTHER VALUABLE RESOURCES CAN FREQUENTLY BE OBTAINED FROM OFFICIAL STATE AND LOCAL HEALTH AND EDUCATION AGENCIES, COLLEGE AND UNIVERSITY HEALTH EDUCATION PERSONNEL, AND/OR LIBRARY REFERENCE GUIDES. Many of the publications and services are free to the public; others involve a nominal charge.

Action on Smoking and Health
2013 H St., N.W.
Washington, DC 20006

Al-Anon Family Group
Headquarters, Inc.
P.O. Box 182
Madison Square Station
New York, NY 10059-0182

Alcoholics Anonymous
P.O. Box 459
Grand Central Station
New York, NY 10163

American Academy of Dermatology
820 Davis
Evanston, IL 60201

American Alliance for Health,
Physical Education,
Recreation and Dance
Assoc. for the Advancement of
Health Education
1900 Association Dr.
Reston, VA 22091

American Cancer Society
777 Third Ave.
New York, NY 10017

American Council on Marijuana
and Other Psychoactive Drugs
6193 Executive Blvd.
Rockville, MD 20852

American Dental Assoc.
Bureau of Health Education and
Audiovisual Services
211 E. Chicago Ave.
Chicago, IL 60611

American Diabetes Assoc.
Two Park Ave.
New York, NY 10016

American Dietetic Assoc.
430 N. Michigan Ave.
Chicago, IL 60611

American Hearing Society
(formerly National Assoc. for
Hearing and Speech Action)
10801 Rockville Pike
Rockville, MD 20852

American Heart Assoc.
7320 Greenville Ave.
Dallas, TX 75231

American Hospital Assoc.
Dept. of Order Processing
840 N. Lake Shore Dr.
Chicago, IL 60611

American Lung Assoc.
1740 Broadway
New York, NY 10019

American Medical Assoc.
Department of Health Education
535 N. Dearborn St.
Chicago, IL 60610

Amer. Medical Assoc. Auxiliary
535 N. Dearborn St.
Chicago, IL 60610

American Optometric Assoc.
Attn: Communications Division
243 N. Lindberg Blvd.
St. Louis, MO 63141

American Osteopathic Assoc.
Public Relations Department
212 E. Ohio St.
Chicago, IL 60611

American Pharmaceutical Assoc.
2215 Constitution Ave., N.W.
Washington, DC 20037

American Podiatry Assoc.
Council On Education
20 Chevy Chase Circle, N.W.
Washington, DC 20015

American Red Cross
17th and D Sts., N.W.
Washington, DC 20006

American School Health Assoc.
P.O. Box 708
Kent, OH 44240

American Social Health Assoc.
260 Sheridan Ave.
Palo Alto, CA 94306

Arthritis Foundation
1314 Spring St.
Atlanta, GA 30309

Assoc. for Retarded Citizens
(formerly National Assoc.
for Retarded Children)
P.O. Box 6109
Arlington, TX 76011

Asthma and Allergy Foundation
of America
1302 18th St., N.W., Suite 303
Washington, D.C. 20036

Blue Cross/Blue Shield Assoc.
676 N. Saint Clair St.
Chicago, IL 60611

Cystic Fibrosis Foundation
Suite 558
3384 Peachtree Rd., N.E.
Atlanta, GA 30326

Epilepsy Foundation of America
4351 Garden City Dr., Suite 406
Landover, MD 20785

Family Service Assoc. of America
44 E. 23rd St.
New York, NY 10010

Group Against Smoker's
Pollution (GASP)
P.O. Box 632
College Park, MD 20740

Kimberly-Clarke
Life Cycle Center
2100 Winchester Rd.
Neenah, WI 54956

Leukemia Society of America
800 Second Ave.
New York, NY 10017

March of Dimes, Birth Defects
Foundation
1275 Mamaroneck Ave.
White Plains, NY 10605

Mental Health Materials Center
30 E. 29th St.
New York, NY 10016

Metropolitan Life Insurance Co.
Health and Safety Education Div.
One Madison Ave.
New York, NY 10010

Muscular Dystrophy Assoc.
810 Seventh Ave.
New York, NY 10019

National Center for Health
Education
30 E. 29th St.
New York, NY 10016

National Council on
Alcoholism, Inc.
733 Third Ave., Suite 1405
New York, NY 10017

National Cystic Fibrosis
Research Foundation
60 E. 42nd St., Suite 1563
New York, NY 10017

National Dairy Council
6300 N. River Rd.
Rosemont, IL 60018

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National Easter Seal Society
2023 W. Ogden Ave.
Chicago, IL 60612

National Fire Protection Assoc.
Batterymarch Park
Quincy, MA 02269

National Genetics Foundation
555 W. 57th St.
New York, NY 10019

National Hemophilia Foundation
19 W. 34th St., Suite 1204
New York, NY 10001

National Kidney Foundation
Two Park Ave.
New York, NY 10016

National Mental Health Assoc.
1800 N. Kent St., 2nd Floor
Arlington, VA 22209

National Multiple Sclerosis
Society
205 E. 42nd St.
New York, NY 10017

National Safety Council
444 N. Michigan Ave.
Chicago, IL 60611

National Society for the
Prevention of Blindness,
Inc.
79 Madison Ave.
New York, NY 10016

National Tay-Sachs and Allied
Diseases Assoc., Inc.
92 Washington Ave.
Cedarhurst, NY 11516

Planned Parenthood Federation
of America, Inc.
810 Seventh Ave.
New York, NY 10019

Public Affairs Committee, Inc.
381 Park Ave. South
New York, NY 10016

Tampax, Incorporated
Department HI
P.O. Box 7001
Lake Success, NY 11042

United Cerebral Palsy Assns.
330 E. 34th St.
New York, NY 10001

United Parkinson's Foundation
220 S. State St., Room 1806
Chicago, IL 60604

FEDERAL GOVERNMENT RESOURCES

Arthritis Information
Clearinghouse
1700 N. Moore St.
Arlington, VA 22209

Cancer Information
Clearinghouse
National Cancer Institute
Office of Cancer Communications
Building 31, Room 10A18
9000 Rockville Pike
Bethesda, MD 20205

Center for Health Promotion
and Education
Division of Health Education
Centers for Disease Control
Atlanta, GA 30333

Clearinghouse on the Handicapped
330 C St., S.W.
Washington, DC 20201

Consumer Information Center
Pueblo, CO 81009

Environmental Protection Agency
Public Inquiries Center,
PM 211-B
401 M St., S.W.
Washington, DC 20460

Food and Drug Administration
Office for Consumer Inquiries
(HFE-88)
5600 Fishers La.
Rockville, MD 20857

Food and Nutrition Information
Center (FNIC)
3101 Park Center Dr.
Alexandria, VA 22302

High Blood Pressure
Information Center
120/80 National Institutes of
Health, Box AP
Bethesda, MD 20205

National Center for Education
in Maternal and Child Health
3520 Prospect St., N.W.
Washington, D.C. 20057

National Clearinghouse for
Alcohol Information
P.O. Box 2345
Rockville, MD 20857

National Clearinghouse for
Drug Abuse Information
5600 Fishers La., Room 10A43
Rockville, MD 20857

National Clearinghouse for
Family Planning Information
P.O. Box 2225
Rockville, MD 20852

National Clearinghouse for
Mental Health Information
Public Inquiries Section
5600 Fishers La., Room 15C17
Rockville, MD 20857

National Diabetes Information
Clearinghouse
Box NDIC
Bethesda, MD 20205

National Digestive Diseases
Education and Information
Clearinghouse
1555 Wilson Blvd., Suite 600
Rosslyn, VA 22209

National Health Information
Clearinghouse (NHIC)
P.O. Box 1133
Washington, DC 20013-1133

National Highway Traffic
Safety Administration (NHTSA)
U.S. Department of
Transportation
400 7th St., S.W.
Washington, DC 20590

National Injury Information
Clearinghouse
5401 Westbard Ave., Room 625
Washington, DC 20207

National Institute For Drug
Abuse
5600 Fishers La.
Rockville, MD 20857

National Institutes of Health
Bethesda, MD 20205

National Heart, Lung and Blood
Institute
Public Information and Reports
Branch
Building 31, Room 4A21
National Institutes of Health
Bethesda, MD 20205

Office of Consumer Affairs
Washington, DC 20201

Office on Smoking and Health
Technical Information Center
Park Building, Room 116
5600 Fishers Lane
Rockville, MD 20857

President's Council on Physical
Fitness and Sports
450 Fifth St., N.W., Suite 7103
Washington, DC 20001

Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

U.S. Consumer Product Safety
Commission
Washington, DC 20207

U.S. Department of Agriculture
Washington, DC 20250

U.S. Department of Health and
Human Services
Washington, DC 20201

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Activity Seven

Health Research Revisited

Objectives

Cognitive: Students will be able to:

- Recognize health research concepts and terms that they may not have recognized before studying the module.

Affective: Students will:

- Gain a sense of mastery over the key concepts and terms presented in the module.
- Become more confident about applying new health data to their own health decisions.

Skills: Students will be able to:

- Apply their new knowledge of research terms and concepts to a health research report.
- Assess their progress in understanding health research reporting.
- Assess their level of understanding basic health research concepts.

Activity at a Glance

By responding to the questionnaire "What Do I Know?," students assess their knowledge of basic health research concepts and their ability to interpret a health research report. Follow-up discussion questions are suggested. This activity could be used as an evaluation device.

Preparation

Duplicate the questionnaire "What Do I Know?," the accompanying newspaper article, and the "What Do I Know? Student Answer Sheet," one copy for each student.

Procedure

1. To begin, explain that students will answer a questionnaire that will help them assess what they now know about health research.

Point out that they should read the health news article that accompanies the questionnaire before they begin answering the questions. They will be able to answer some of the questions simply by thinking logically about them. For other questions, they will have to refer to the article.

Emphasize that this questionnaire is one indication of what they have learned from the module, but not the only measurement. Also important are the class discussions during module activities, their personal Health Decision Logs, the discussion of the answers to this questionnaire and their reaction to health news in the future. (Note: You can decide to what extent you will use the questionnaire results as a class evaluation. You may also want to include other evaluation activities.)

You can expect students to take between 20 to 30 minutes to complete the questionnaire. However, be sure to give everyone enough time, within the limits of one class period, to finish the questionnaire. If students take a long time, you may have to postpone the follow-up discussion to another class session.

2. Collect the "Answer Sheets" as students finish. You may want to ask students to make a duplicate of their answers on a separate piece of paper and keep their questionnaires, so that you can all go over the activity when everyone is finished.

3. Use the following key to tally the scores. Give five points for each correct answer to questions 1 through 20. In addition to marking each question right or wrong, place the total score at the top of each page.

Answer Key

1.	b	6.	b	11.	b	16.	b
2.	c	7.	c	12.	b	17.	d
3.	b	8.	a	13.	c	18.	a
4.	c	9.	c	14.	c	19.	d
5.	d	10.	c	15.	c	20.	a

For your convenience, we have summarized these instructions at the top of the student Answer Sheets. You may wish to read these instructions aloud, allowing for further student questions, before you begin.

4. When everyone has finished responding to the questionnaire and the answer sheets have been collected, review the questions and discuss the correct answers. Then broaden the discussion to issues about research methods, assumptions about research, personal attitudes, and general reactions to the module.

For example, question 2 can be discussed: Knowing where a research study was conducted and who did the research is one important piece of evidence for evaluating the credibility of the report, but point out that it is not the only source of evidence, and it may not be the best guide.

For another example, a student could say, "Well the report just talks about adults, how is it relevant to me?" You can emphasize that although most epidemiological studies have been done with adults, they have implications for adolescents because adolescents are beginning to form health habits and to make health decisions that will affect their adult life. Most of the major diseases that afflict adults in the U.S. today may well have had their origins in lifestyle decisions (smoking, diet, exercise, etc.) made many years before the disease becomes obvious.

5. As an optional follow-up activity, you may want to ask students to write about what they learned from using the module. You can ask:

- What did they find most interesting? Least interesting?
- What surprised them the most?
- Have any of them decided to do anything differently as a result of studying about health research? If so, what?

WHAT DO I KNOW?

STUDENT ANSWER SHEET

Instructions

We hope that with the help of this module you have begun to learn how to unravel the mysteries of health research and to discover ways to use health research findings in your daily lives.

"What Do I Know?" is a series of questions to help you assess what you have learned about the health research process. First, carefully read the newspaper article that accompanies the questionnaire. Then answer the questions.

Put all your answers in the space provided below. As soon as you finish reading these instructions, you may begin the questionnaire.

Put your answers here:

1. ____
2. ____
3. ____
4. ____
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6. ____
7. ____
8. ____
9. ____
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20. ____
21. ____
22. ____
23. ____

WHAT DO I KNOW?

Questionnaire

1. This study is part of the ongoing controversy about

   (a) whether men or women are healthier.

   (b) the relationship between lifestyle habits and health.

   (c) whether smoking or alcohol is more dangerous to your health.

   (d) the relationship between exercise and sleep.

2. The hypothesis of this study is

   (a) do not smoke cigarettes, get eight hours of sleep nightly, and use alcohol moderately or not at all.

   (b) differences in interpreting research are a matter of looking at statistics in different ways.

   (c) people who live moderate and regular lifestyles improve their health and generally have a better chance for long life.

   (d) there are specific rules you can follow to be sure that you will be healthy.

3. It is important to know who did the research and where the study was conducted because

   (a) unless research studies are done at universities they cannot generally be counted on to produce accurate findings.

   (b) sometimes researchers or their employees may have an interest in the outcome that makes them emphasize only certain aspects of the study's result.

   (c) research done in this country is usually more accurate than studies conducted in other countries.

   (d) a study cannot be taken seriously unless the researcher and the research institution are famous.

4. The sample for this study is

   (a) the seven basic health rules.

   (b) men and women aged 45.

   (c) 6,928 Californians.

   (d) the researchers who did the study.

5. The type of research reported in this article is

   (a) a clinical study.

   (b) a toxicological study.

   (c) an intervention study.

   (d) an observation study.

6. From this study, I can conclude that

   (a) following the seven basic health rules will guarantee me a longer life.

   (b) following the seven health rules will increase my chances for a longer life.

   (c) this study does not apply to me because I am not an adult.

   (d) moderation in all things will guarantee me a longer life.

7. The study is one example of the fact that

   (a) research results can change over time.

   (b) a study must take at least ten years before the results can be certain.

   (c) many research questions dealing with human subjects take a long time to investigate.

   (d) the time it takes to do a study has very little to do with the study's results.

8. The article reports that two researchers found both overweight and underweight to be unhealthy. Two others think overweight is the real danger. Even though there is disagreement, we can conclude that

   (a) being overweight is often a health problem.

   (b) it is healthy to be underweight.

   (c) researchers agree that it is unhealthy to be modestly underweight.

   (d) weight is not a major factor influencing health.

9. The best indication that the results of this study are believable is that

   (a) the study was repeated on another group of adults under similar conditions with the same results.

   (b) adults in California are very much like adults in other parts of the country.

   (c) the results of the study remain pretty much the same over time.

   (d) the School of Public Health at the University of California at Los Angeles is a respected research institution.

10. Which of the following reasons is the best reason we may never be certain about the major findings of this research study?

   (a) Skeptics will always raise nagging questions.

   (b) At least 60 percent of all the adults in the United States were not tested.

   (c) We cannot always test humans completely because of concerns for their safety and well-being.

   (d) Two groups of researchers are in disagreement about specific details.

11. Which of the following statements from the study best illustrates that "Conclusions about 'risk factors' are guides to individuals, not guarantees"?

    (a) "Men who followed no more than three of these rules died at nearly three times the rate of men who followed six or seven."

    (b) "People who live moderate and regular lifestyles really do improve their health....Some people who follow all the rules do die early."

    (c) Drs. Wiley and Comacho "conclude that probably only five of the health practices are crucial."

    (d) "The people with the poorer sleep and eating habits may just be those who are ill and near death."

12. One thing that can be learned about research from the researchers' disagreements about their findings is that

    (a) there are too many different opinions about everything to believe any research results.

    (b) research leads to new knowledge, but also uncovers new questions.

    (c) researchers are almost always in disagreement.

    (d) it is required in reporting the results of one research study to report the findings of an opposing point of view.

13. The results of the study begun in 1965 were not published until 1973 because

    (a) it is difficult to get research results published.

    (b) the research results were too controversial.

    (c) the research question required that the participants be studied for a long period of time.

    (d) it is likely that a cigarette manufacturer was working to keep the results from being made public.

14. The results of this study add weight to the argument that

    (a) men are healthier than women.

    (b) smoking is okay as long as you quit within ten years.

    (c) moderation in many lifestyle habits contributes to good health.

    (d) people who exercise a lot are healthier than people who exercise just a little.

15. The study reports that some people who follow all of the seven health rules die early. We can conclude from this that

    (a) some of the seven rules are actually not good for your health.

    (b) strenuous exercise leads to early illness and/or death.

    (c) following the seven health rules is only a guide to good health, not a guarantee.

    (d) the basic health rules can only be expected to work with 50 percent of the adult population.

16. The fact that two groups of researchers disagree about some of the findings illustrates that

    (a) both groups of researchers are wrong.

    (b) researchers can reach different conclusions from the same study.

    (c) you need at least three groups of researchers to reach a definite conclusion.

    (d) one group of researchers is right and one is wrong.

17. A hypothesis is

    (a) a method of measuring change in research studies.

    (b) a set of specific recommendations that are made from a research study.

    (c) a way of interpreting statistics.

    (d) an explanation that can be tested.

18. An intervention study

    (a) tests a hypothesis by treating one group in a certain way and comparing this group with a group that is not treated.

    (b) tests the researchers by giving them a series of tasks to see if they are qualified to conduct the research study.

    (c) tests the research subjects to see if the subjects are eligible to take part in the study.

    (d) tests the results of a study to determine their accuracy.

19. A sample is

    (a) the number of studies previously conducted on the same or similar topics.

    (b) the major topic of the study.

    (c) the main characteristic of the group or thing being studied, such as age or sex.

    (d) the part of a group that is studied to gain information about the whole group.

20. A control group is

    (a) the group in a research study that receives no treatment.

    (b) the largest group in a research study.

    (c) the group that does what the researchers recommend as a result of a research study.

    (d) the group of researchers who conduct a research study.

21. Which of these statements describes your thinking about research? (Choose as many of the answers as apply to you.)

    (a) The experts don't even agree among themselves, so I don't plan to do anything until they do agree.

    (b) I think there are some things I can learn from research that will guide me in making health decisions for myself.

    (c) I am pretty healthy now, so I don't think I need to pay much attention to research studies until I am older.

    (d) Right now I don't know enough about research to apply the results of most studies to my own life.

    (e) I feel motivated to pay attention to health research reports and to learn more about them.

22. After studying this module, I have learned that: (Choose the one response that best applies to you.)

    (a) I had never given much thought to research reporting, but I can see that it is important for my health and well-being that I know something about it.

    (b) I had never given much thought to research reporting, and I cannot see that it is very important for my health and well-being that I know anything about it.

    (c) I had given some thought to research reporting before, but I still feel I don't know much about it.

    (d) I had given some thought to research reporting before, but I think I know quite a bit more about it now.

23. I found this module: (check one)

    (a) very interesting

    (b) mildly interesting

    (c) not interesting at all.

Seven Simple Rules for Longer Life Emerge from Ten-Year Survey

By Victor Cohn

Washington Post Staff Writer

Following seven simple health rules can extend a man's life by 11 years on the average and a woman's by seven, according to one of the nation's most significant public health studies.

Among 6,928 Californians who followed most of these rules during the years 1965 through 1974, there were far fewer deaths than expected. Men who followed no more than three of these rules died at nearly three times the rate of men who followed six or seven. Women who followed no more than three died at twice the rate of those who followed six or seven.

The seven health rules:

- Do not smoke cigarettes.
- Get some regular exercise.
- Use alcohol moderately or not at all.
- Get seven to eight hours of sleep nightly.
- Maintain proper weight.
- Eat breakfast.
- Do not eat between meals.

These conclusions were published last week by Dean Lester Breslow and Dr. James Enstrom of the University of California at Los Angeles' School of Public Health. Breslow is an authority on practical steps to prevent illness.

In an interview, he called the study "one of the first large-scale demonstrations" of the association among ways of life, health and death.

In a separate analysis of the same group, Dr. James Wiley and Terry Camacho of the California Health Department conclude that probably only five of the health practices are crucial.

The differences in interpretation are a matter of "looking at the statistics in different ways," Breslow said.

What is "really important," he said, is that "we believe we have shown" that people who observe all or virtually all these practices, "people who live moderate and regular lifestyles," really do improve their health and have a better chance, on the average, for long life.

Some people who follow all the rules do die early. But the California study--a project of UCLA and the California Health Department's Human Population Laboratory--clearly seems to have three main lessons. Following good health habits can pay. The more good habits, the better. Changing a bad habit to a good one, like stopping smoking, also pays.

The Health Department first surveyed the health habits of 6,928 Alameda County (Berkeley area) adults in 1965. Drs. Nedra Belloc and Breslow published the first results in 1973.

The time-consuming new analyses, published in Preventive Medicine, take the group through 1974. By then, there were 6,246 survivors. Of these, 4,864 participated in the latest survey. Also, death certificates from California and other states were scrutinized to determine how many of the others died.

When the California health scientists first said in 1973 that--for men or women aged 45--following all seven habits lengthened life by several years, some skeptics said, in effect, "You may be way off. The people with the poorer sleep and eating habits may just be those who are ill and near death."

The fact that the same kind of results has held up over the years makes them far surer, Breslow said. Some other important points:

1. Breslow and Enstrom list "never" smoking as one of their optimum health habits. But Wiley and Camacho add that light-to-moderate smokers who quit smoking by 1965 showed the greatest improvement in health by 1974.

2. Breslow-Enstrom found both overweight and underweight to be unhealthy. Wiley-Camacho think obesity is the real danger, not modest underweight.

3. Some persons who preach physical activity say only strenuous exercise really helps. Wiley-Camacho find a "marked" difference in health between those who report no activity and those who report even a little, but no consistent trend showing better results for strenuous exercises.

Breslow said "we can't be sure" about such details when "we break the larger group into sub-groups," because there aren't enough people in the sub-group--light and heavy exercisers, for example.

What "we do get," he said, is a whole picture of how to be healthy.

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Appendix I

More Articles About Health News

The following articles can be used as an extension of Activity Five, Asking Smart Questions. The issues involved are:

Thinness and Longevity—another side of the argument presented in the article in Activity Five.

Acne

Coffee and Cancer. This section includes not only the lead article and suggested answers to the "Smart Questions," as do the above sections, but also two other articles reporting on the same findings. The three articles can be used together to analyze differences in reporting on the same new health research findings.

Thinness Linked to a Long Life

FRAMINGHAM, MASS. Nov. 17 (AP)—Skinny people who don't smoke much or at all live the longest, a new study contends.

"If you show me a thin person who isn't a heavy cigarette smoker, I'll show you the person who does the best—the lowest death rate, the lowest stroke rate, heart attack rate, the whole bit," said Dr. William Castelli, director of the Framingham Heart Study. Findings of the study, which has been following the health of 5,200 Framingham residents since 1948, will be published soon, Dr. Castelli said.

The report contradicts conclusions last spring by Dr. Reubin Andres of Johns Hopkins University, who said the healthiest people were somewhat overweight.

"We're saying that can't be right, Dr. Castelli said.

Both the findings of Dr. Andres and Dr. Castelli's were based on statistics that show that people who weigh the most or the least are most likely to die before their time.

But Dr. Castelli told The Middlesex News that the thinnest people on the charts smoked and died from cancer and when the smokers were eliminated from the averages, the figures showed thin people lived the longest.

Associated Press

THINNESS LINKED TO A LONG LIFE

(Associated Press, November 17, 1981)

Note that this article is related to the article "For Healthier, Longer Life, Don't Think Too Thin" in Activity Five of this module. Point out to students that the same issue is being further researched and discussed approximately a year later (December 27, 1980 - November 17, 1981).

(1) Dr. Castelli is cited as director of the Framingham Heart Study. From the article alone, students couldn't know that this study is nationally and internationally respected, and is sponsored by the National Institutes of Health (National Heart, Lung, and Blood Institute). Clues that the study is a substantial one, though, are that it involves 5,200 people and has been continuing since 1949. Note that the article doesn't describe the study further because: (a) the article apparently needed to be short to fill the news space, and (b) the article originated in Framingham, where people know about the study and Dr. Castelli. Dr. Andres is cited as associated with Johns Hopkins University, a well-respected university and medical center. (In the 1980 article, he is also cited as clinical director of the National Institute on Aging.)

(2) The article does not state who sponsors the Framingham Heart Study. There is also nothing in the article that would indicate bias.

(3) Dr. Castelli is responding to the same issue addressed in the 1980 article about Dr. Andres' research findings: the relationship between weight and longevity. There is no indication in the article that either researcher or their sponsors would be affected financially by the research results.

(4) The only qualifier in this article is in the fifth paragraph: "...are most likely to die before their time." The rest of the wording seems to point out the contradictions between the two viewpoints.

(5) The Framingham study involved people ("5,200 Framingham residents"); this article does not indicate whether it's an intervention or observation study. Even though the article doesn't say, students might be interested to know that Dr. Andres' research also involved people; again, the research is not described here. (The 1980 article indicated observation studies.)

(6) The article does not say whether there are other Framingham-type studies. It does say this study has been going

on since 1949, however, so students could guess that the study procedures have been repeated many times. (The 1980 article said Dr. Andres used several studies, but they were not replications of a particular study.)

(7) The article does not describe the subjects.

(8) The point of this article is that when another factor is considered--smoking--conclusions about the relationship between people's weight and how long they live are affected. This should alert students that articles just about weight and longevity need to be approached very carefully. Other factors that might be considered are family history, any diseases present, exercise, etc.

(9) The article points out that both researchers are looking at "statistics that show that people who weigh the most or the least are most likely to die before their time," but they are interpreting these statistics in different ways. The article is too short, though, to include other background.

(10) Research conclusions about weight and longevity are affected by other health factors. There are statistics indicating that thin people may die earlier than middle-weight people. However, new evidence suggests that many of the thin people in the statistics died from smoking-related diseases; and that when those people are separated out, the thin non-smokers lived longer than other groups.

(11) How many of the very heavy people were smokers, and how would that affect the statistics? How do other health factors affect people's weight and how long they live?

(12) This study is obviously part of the ongoing controversy about the relationship between weight and longevity. The side of the controversy that gains evidence here is the side that cautions people about thinking they can gain extra weight without negatively affecting their health. (In addition, the smoking issue is involved here, with further evidence that smoking causes death in people who weight-wise would have a good chance for a long life.)

(13) Teenagers are usually very conscious of their weight and appearance. They are also at an age where their eating habits are being established, yet where nutritional needs may change with their developmental stage. It should be helpful for students to understand that research about weight is very complex; that news about such research needs to be looked at very carefully; and that while general information about weight can be found from a variety of sources, conclusions about a particular individual's weight should come from a doctor or other qualified medical professional.

Clearing Up Acne

More than three-fourths of acne sufferers can clear up their skin and prevent new outbreaks with nonprescription lotions, creams and gels containing sulfur, benzoyl peroxide, or sulfur combined with resorcinol, according to the Advisory Review Panel on Over-the-Counter Antimicrobial Drug Products, which reports to the Food and Drug Administration. The panel found that the other sufferers must turn to prescription drugs under the supervision of a physician. Abrasive scrub products were found effective to clean oil off the face and keep pores open, but not in actually reducing lesions. And the panel had good news for junk food junkies, it says there's just no proof that such food has any effect on acne. The FDA is receiving comments on the panel's report, then it will draw up standards to which all acne products must conform.

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CLEARING UP ACNE

(The Washington Post, March 29, 1982)

(1) The article does not say who is on the Advisory Review Panel. To be appointed to a national advisory panel, however, a person usually needs to have strong credentials and recognized knowledge in the field.

(2) There is no way of knowing from the article. The agency the panel is reporting to, however, the Food and Drug Administration, is a federal government agency, and is responsible for being unbiased in its evaluation of medicines. (Note: Here is one of several instances where students will find that their knowledge from other subjects, like social studies/civics, can be usefully applied in interpreting health news reports.)

(3) People are responding at the time the article was written. ("The FDA is receiving comments on the panel's report....") What kinds of organizations might send comments? (acne medication manufacturers, "scrub product" manufacturers, junk food producers, nutrition education groups re: junk food statement, dermatology organizations, etc. Note that some of these groups would be affected financially by the FDA standards.)

(4) There are no qualifying words in this article. After using this module, however, students should recognize some overly definite language here: "...there's just no proof that such (junk) food has any effect on acne." Because students should be aware that there is controversy about junk food and acne, this wording should raise a "red flag" about either the panel's conclusion about junk food or the way this reporter has reported that conclusion.

(5) The article does not say. One could guess that the research was done on humans; one rarely if ever hears about acne on animals.

(6) The article does not say whether or how often the studies were replicated.

(7) The article does not describe the group(s) of subjects used. Because the topic is acne, however, the results apparently apply to people who now suffer from acne or who are at risk for developing acne.

(8) The article does not say whether any factors other than medications, scrub products, and junk foods were considered in the study. Other factors that could have been considered are: age, skin type (dry, normal, oily), male or female, climate lived in, other eating habits besides junk foods, other products used on the face (for shaving, or make-up), etc.

(9) Because the article is very short (in newspaper terms, a kind of "filler" article), it does not give any background on what is known and not known about the topic.

(10) There is some evidence that most acne can be successfully treated with nonprescription lotions, creams, and gels containing sulfur, benzoyl peroxide, or sulfur combined with resorcinol. If these do not work, prescription drugs (used under a physician's supervision) are probably necessary. Scrub products are probably good for just that: scrubbing to keep the face pores clean. Junk food may not have a significant effect on acne; note, however, that the article says nothing about junk food being unimportant in relation to other health issues, like weight. The FDA will be receiving comments about all this, and will be developing new standards for acne products. (Students can expect to hear more about this in the future.)

(11) What is the role of junk food in acne? What are the roles of the other factors in #8 above? How long should someone use a nonprescription product without success before going to a doctor? Will using a scrub product help prevent acne in someone who does not have it now but may be at risk for developing it? What other research has been done about acne?

(12) Yes, acne treatment is a controversial topic. This study has given added weight to the use of nonprescription products, and the nonsignificant involvement of junk foods.

(13) Information about acne will be relevant to many teenagers. There may be enough information in this article to make a teenager begin to consider changing a health decision related to acne, but certainly not enough information to actually make a change. Interested students could look for other articles on the subject in the Readers' Guide to Periodical Literature in a library, ask their doctor and/or pharmacist, contact a professional dermatologists' organization, or use one of the other sources discussed in Activity Six.

Coffee—A Cancer Culprit?

Cancer of the pancreas has spread with baffling and deadly results: U.S. cases have doubled in two decades and the disease now kills 20,000 Americans annually. It is also one of the hardest cancers to treat; hardly any of its victims survive more than three years. Drinking and smoking have long been suspected as possible causes. But a team of Harvard experts last week suggested another culprit: coffee.

The team's evidence is admittedly preliminary. More than 50 percent of all Americans over the age of 10 drink an average of three cups of coffee a day. If there is a link between coffee and cancer, this would suggest that the epidemic would be far worse. Nonetheless the findings can't be dismissed. Dr. Brian MacMahon, a veteran epidemiologist at the Harvard School of Public Health, and his colleagues interviewed 369 patients with pancreatic cancer at eleven New England hospitals. In particular, they queried the subjects about their use of alcohol, tobacco, coffee, and tea. Their responses were compared with those of 644 patients hospitalized with other diseases. By turning up differences in habits or environmental factors, such "case control" studies often provide early clues to the causes of certain diseases. It was this technique that sounded the alarm of a link between cigarettes and lung cancer.

At the outset, the Harvard investigators wanted to check out the role tobacco and alcohol might play in pancreatic cancer. They found a "weak" association with cigarette smoking: smokers had about a 40 percent higher risk. No difference was found in drinking habits between the pancreas-cancer patients and the controls, effectively ruling out alcohol as a possible causative factor. But, the team reported in the New England Journal of Medicine, "an unexpected association of pancreatic cancer with coffee consumption was evident."

Three Cups a Day: Pancreatic cancer patients drank significantly more coffee than did their peers with other diseases. This led the statisticians to conclude that drinking up to two cups a day increased the risk of pancreatic cancer by 1.8 times, and three or more cups raised the risk nearly threefold. The team estimated that coffee drinking in the United States could account for half of all cases of pancreatic cancer. The study showed no link between tea and this type of cancer, suggesting that caffeine, found in both coffee and tea, probably isn't the substance responsible.

Coffee has been suspect in a number of health problems over the years. The beverage has been linked to ulcers, heart attacks and birth defects. A few reports have also raised the question about its role in cancer of the pancreas. British epidemiologists noted that this type of cancer seemed most common in countries where the consumption of coffee was highest. Other researchers have observed that while pancreatic cancer was increasing among most groups in the United States, low rates persisted among Mormons and Seventh-day Adventists, who abstain from coffee. Finally, a University of Maryland team recently reported an increased risk for men who drank decaffeinated coffee and were also regularly exposed to gasoline and cleaning fluids. Until recently, they noted, a chemical in dry-cleaning agents, called trichloroethylene, was also used to remove caffeine from coffee beans.

Important questions were quickly raised about the Harvard study. The National Coffee Association said that "extensive animal research," sponsored by the industry, had failed to show any link between coffee and pancreatic malignancy. The association also noted that hospital patients, used as controls in the study, may not be truly representative of the public at large. Many of the controls might have stopped drinking coffee because of digestive or other disorders, thus providing an artificially low rate of coffee consumption for the group. The study questionnaire inquired about drinking habits only at the time they became ill.

MacMahon and his colleagues concede that their study doesn't prove a solid cause-and-effect relationship. They now plan follow-up research to answer such questions as how long patients have been drinking coffee, what they mix in it, how they brew it and what brands they favor. Meanwhile, MacMahon says he has given up coffee himself—at least for the time being.

Matt Clark with Phyllis Malamud in Boston.

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COFFEE--A CANCER CULPRIT?

(Newsweek, March 23, 1981)

(1) The primary researcher (known in research as the "principal investigator") for this study is Dr. Brian MacMahon. The article notes that he is a "veteran epidemiologist at the Harvard School of Public Health." There, he has qualifications and experience, and is associated with a well-respected institution.

(2) The article does not say who sponsored the research. However, it was conducted through the Harvard School of Public Health, and there is no reason to believe that either the institution or the researchers have a financial interest or other bias in the results.

(3) The National Coffee Association has responded. Students should be able to deduce that this is a trade association responsible for promoting the use of coffee. The coffee industry would obviously be financially affected if the results of this study caused many people to stop or significantly reduce their coffee drinking. Note, however, that the questions raised by the NCA are valid ones, which will need to be addressed in future research on this topic.

(4) Note the following qualifying words: "admittedly preliminary" (second paragraph); "could account for" and "probably isn't" (fourth paragraph); "seemed most common" (fifth paragraph); "may not be truly representative" and "might have stopped" (sixth paragraph).

(5) This was an observation study, with people as subjects, in which scientists observed differences in some personal habits. The article calls it a "case control" study which is one particular kind of observation study.

(6) This result was unexpected, and is apparently the first finding of its kind in humans. The National Coffee Association says that it has evidence from "extensive animal research," which may or may not have been replicated.

(7) The subjects were all patients in New England hospitals. For now, this does limit the extent to which the results can be applied. Further studies will need to be done with non-hospitalized people.

(8) Besides the hospitalization factor, there are several other factors which might have influenced the results. The article notes that these factors include: how long patients have been drinking coffee, what they mix in it, how they brew it, and what brands they favor. Chemicals used to decaffeinate coffee may also be involved. Other factors, like smoking, could combine with the effect of coffee.

(9) The article gives useful background about both pancreatic cancer and previous research about the health effects of coffee.

(10) There may be an association between coffee drinking and pancreatic cancer, but the evidence is very preliminary. Further research studies will be done and publicized on this topic.

(11) Questions for future research are noted in #7 and #8 above. Students may be curious about how (and if) these factors will turn out to be related to pancreatic cancer. Also, why does the article call a 40 percent higher risk for smokers a "weak" association?

(12) This topic is obviously part of an ongoing controversy. ("Coffee has been suspect in a number of health problems over the years.") This study adds some weight to the side of the controversy that says coffee is related to health problems. However, note that "The team's evidence is admittedly preliminary" and "MacMahon and has colleagues concede that their study doesn't prove a solid cause-and-effect relationship."

(13) Some teenagers are already coffee drinkers, and many will become coffee drinkers as adults. (What do students think about the statistic that "More than 50 percent of all Americans over the age of 10 drink an average of three cups of coffee a day"?) Although Dr. MacMahon has given up coffee himself as a result of his research, there is not enough information in this study or article to justify a widespread health recommendation to stop drinking coffee. Students may want to look at how much coffee they do drink, if any, and whether there are alternative beverages they might enjoy as much, at least sometimes. (Also, what advantages and disadvantages those drinks might have, like vitamins in fruit juices and excess sugar in many soda drinks.) Nutrient information about beverages can be obtained for other news reports about this topic in the future.

(Note: To compare this news report with others, see the following two articles: "Coffee--Harvard Scientists Find Link to Pancreatic Cancer," Washington Post, March 12, 1981, and "Coffee and Cancer: A Brewing Concern," Science News, March 21, 1981.)

Coffee: Harvard Scientists Find Link to Pancreatic Cancer

By Victor Cohn
Washington Post Staff Writer

Harvard University scientists have found a suspicious and alarming association between coffee drinking and cancer of the pancreas, one of the fastest-killing of all cancers.

Though the link is not yet proved and more studies are needed, the Harvard study's main author, epidemiologist Dr. Brian MacMahon, said yesterday he gave up coffee a month ago.

"I'm fairly convinced this is a real thing," he said, but "I would not give any advice to others yet. I'm in the business of collecting facts."

The data, reported in today's New England Journal of Medicine, show that:

- About 24,000 Americans each year get cancer of the pancreas, a large abdominal organ that secretes digestive enzymes and insulin. Only 1 or 2 percent will survive as long as five years. This dismal record means pancreatic cancer ranks only after lung, colon and breast cancers as a cause of death.

- MacMahon's Harvard School of Public Health team studied 369 patients with this cancer and compared them with a "control group" of 644 patients with other disorders. There were only 20 noncoffee drinkers among the pancreas cancer patients, but 88, or 13 percent, among the controls, enough to make a reliable statistical base. The inquiry showed drinking up to two cups of coffee daily had apparently increased the risk of pancreas cancer by 1.8 times or nearly two-fold, and drinking three or more cups increased it by 2.7 times or nearly three-fold.

If the coffee-pancreas cancer link is confirmed, just over 50 percent of such cancers may be caused or partly caused by coffee, the Harvard group believes.

- The chance of developing such cancer, like most cancers, is generally small in younger years and increases with age. Many kinds of cancer take 20 to 30 years to develop.

If coffee is indeed implicated in half of all pancreas cancer, said MacMahon, a non-coffee drinker aged 50 to 54 might have 7 chances in 100,000 of getting pancreas cancer in any single year; one aged 60 to 64, 19 chances in 100,000; one aged 65 to 69, 27 chances—with coffee drinkers' chances about doubled or tripled.

The Harvard group also found a "weak association" between cigarette use and pancreas cancer, but none with cigars, pipes, alcohol or tea. Since both coffee and tea contain caffeine—the average cup of tea, one not too strong, has about half as much caffeine as the average cup of coffee—"we don't believe" caffeine is the guilty substance, "though it's not yet ruled out," MacMahon reported.

Coffee has been under investigation in recent years in several disorders. There is no strong evidence that moderate coffee use increases the risk of heart disease, despite some allegations.

The National Coffee Association in New York said yesterday that the Harvard study has many serious defects and that "extensive animal research" by the coffee industry has found no connection between coffee and cancer.

Last year the Food and Drug Administration warned pregnant women they should stop or "minimize" coffee, tea and cola drinking because the caffeine in all three may cause birth defects. The evidence here, too, is not yet conclusive, said FDA officials, but there is enough evidence to warn the "prudent."

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Coffee and Cancer: A Brewing Concern

People who drink coffee may be at double or triple the risk of developing pancreatic cancer, a rare but lethal disease, according to epidemiologists at the Harvard School of Public Health. If their "unexpected" finding is confirmed, and "if the distribution of coffee consumption in our control group reflects that in the general population," the Harvard group says, "we estimate the proportion of pancreatic cancer that is potentially attributable to coffee consumption to be slightly more than 50 percent." But before banning the brew, remember that the jury is still out. Even Brian MacMahon and his Harvard colleages point out that other data must be evaluated "before serious consideration is given to the possibility of a causal relation" between coffee and cancer.

MacMahon's project, described in the March 12 *New England Journal of Medicine*, was actually designed to reexamine the incidence of pancreatic cancer in relation to its victims' smoking habits and to explore whether alcohol consumption plays a confounding role. The survey involved 369 pancreatic-cancer patients and a "control" group of 644 hospitalized patients with other ailments. Each was asked about smoking habits. Questions also probed the frequency with which each consumed alcoholic beverages prior to onset of the disease, the age span over which they drank and the beverage they consumed most often. Data about tea and coffee habits were limited to the typical number of cups consumed before onset of their current disease became evident.

The researchers observed no link between pancreatic cancer and use of alcohol, tea, pipe tobacco or cigars. There appeared to be a "weak positive association" between cigarette smoking and the disease—also noted in at least two earlier studies—though "only the data for women showed a significant dose-response relation." Coffee consumption was another matter.

Coffee-drinking men—regardless of how much they drank—showed a "flat" but statistically significant excess risk of pancreatic cancer over men who avoided the brew. But among women coffee drinkers, pancreatic-cancer risk increased in proportion to how much coffee they consumed. Combining both sexes, the pancreatic-cancer risk (adjusted for age and sex) showed no elevation for non-coffee drinkers, a doubling (2.1) for those drinking a cup or two daily and more than a three-fold increase for those downing at least five cups a day. MacMahon plans a follow-up study hoping to confirm or rebut these findings.

Another recent epidemiological study (SN: 1/31 81, p. 71), this one by Irving Kessler and Ruey Lin at the University of Maryland, also suggests that "one or more constituents (or contaminants) of coffee may contribute to the risk of pancreatic cancer." Because so many pancreatic-cancer patients in their study drank decaffeinated coffee, solvents such as the animal carcinogen trichloroethylene—used in decaffeinating coffee—"come immediately to mind," the researchers said. But many other factors were also linked with the cancer.

What does all this mean to the hard-core coffee addict? "Prognosis of [pancreatic] cancer is very unfavorable and therefore even a preliminary finding such as that of Dr. MacMahon's study arouses great concern," says a National Cancer Institute announcement. In fact, pancreatic cancer accounts for about 20,000 deaths in the United States annually, more than any other except colorectal, lung and breast cancers. However, NCI adds, "caution should be exercised regarding overreacting to a preliminary finding until results of further studies are reported."

But Kessler offers a further note of caution in interpreting the Harvard group's findings. After looking at a "whole constellation" of risk factors, he concludes that "there is substantial evidence" for believing that most human pancreatic cancers result from no one single factor—such as coffee drinking—but rather from a synergistic host of interacting factors.

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Appendix II

Background Information For Teachers

"News from Health Research: Toward a Better Understanding", by Jane A. Jacobs

"Statistics and Probability: A Sure Thing for Elementary Classrooms", by Marilyn Burns

Note: You may also want to read the article "Who Knows Best--The Doctor or the Reporter?" in the November 27, 1983 issue of TV Guide, pp. 43-46.

News From Health Research: Toward a Better Understanding

By Jane A. Jacobs

Abstract

News about health research findings, especially regarding controversial topics, can seem confusing and conflicting to students and the public. Many people eventually develop a "turned-off" attitude toward all health news. Yet medical information is one of the key factors involved in health decision making, because it influences a person's judgment about the potential health impact of a behavior choice.

As part of their health education, youngsters need to learn skills to better understand and evaluate reports of research news, so the information available for health decision making will be more complete and accurate. Such news is already abundant in television, radio, newspaper and magazine reports and will continue to increase as research advances, knowledge expands and health "facts" are revised.

This article outlines concepts and skills to help teachers and students understand the changes and controversies in health news. To most effectively use new information generated by medical research, students need to: 1) understand basic concepts about the nature of research and the research process; 2) apply critical thinking approaches to health news; and 3) locate additional health information resources. Generating ways to address these needs is a high priority of the school health education work at the National Heart, Lung, and Blood Institute. Comments are invited on this approach.

* *

Picture yourself in front of your home television, watching the early evening news. A medical graphic of some kind flashes onto the background screen as the newscaster reports, "Today at X University, Drs. Y and Z announced the results of a scientific study which shows that..."

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Also see publisher's errata on p. 76 of the February 1983 issue. (The version printed here in this Appendix has already been corrected.)

When the 30-to-90 second news item about the research study is over, what will happen to that piece of information relayed to millions of people? Will it prompt responses like, "One more thing is bad for my health? I'm going to just tune out all of those studies and live my life;" or, "Now they're saying that's OK for you? A month ago some other scientist said it was harmful for my health. When those researchers get their act together, I'll start listening." Will it prompt a simpler reply of "Oh", then be forgotten? Or will it spark an instant controversy, with headlines for days and discussions everywhere?

For school health educators, the key question is: **Are young people being prepared to understand and use reports of new health information as it is discovered and publicized, to help them make informed health decisions throughout life?**

Currently, preparation for health decision making generally includes teaching about:

- self-awareness, self-value and self-responsibility for healthy practices and lifestyles;

- basic information about anatomy and physiology;

- current "facts" about how the functioning of the body systems is affected by factors such as the food we eat, whether we smoke and what our environment is like; and

- Some specific decision making skills, such as how to respond to peer pressure and how to weigh alternatives.

Note that we teach youngsters medical and health facts **as we know them today**. As health research advances, however, today's "facts" may change. Some will be further substantiated; others will be "disproven" and replaced by more accurate "facts"; many will become controversial, even for extended periods of time.

Assuming that health decisions are based partially on available "facts" about the impact of various choices, it becomes very important to be able to evaluate new facts and sort out conflicting ones, both now and throughout life. Even attitudes are involved here, because the lack of these evaluation skills promotes a "tuned-out" attitude toward research news and health recommendations. If it seems as if "Everything causes cancer" or "Even the experts don't know how what I eat affects my health," youngsters and adults easily can decide to ignore all health news.

Television, radio, newspaper and magazine reports of health research news are frequent now and will continue to increase. This article outlines concepts and suggestions for teaching youngsters to better understand the changes and controversies in health news to give them the best available "facts" to use in their health decision making. To most effectively use new information generated by health research, students need to:

1) understand basic concepts about the nature of research and the research process;

2) apply critical thinking approaches to health news; and

3) locate additional health information resources.

UNDERSTANDING BASIC CONCEPTS ABOUT RESEARCH AND THE RESEARCH PROCESS

Scientific expertise is not necessary to understand the research process and its results. Basically, health research involves testing, one at a time, the parts of an educated guess (hypothesis) about how living beings function. Because nature is so complex and involves so many variables, a single experiment rarely has "complete" or "perfectly clear" results. Therefore, many experiments must be completed to address the same question. These variations add different pieces to the puzzle. When a single experiment can be repeated by several different scientists with the same results, its conclusions become more and more accepted.

Public confusion about health research findings understandably results when many complex experiments are conducted simultaneously, while an independent, aggressive media industry seeks "headline news." Because health is a subject highly relevant to the public, and because mass changes in health habits often have large economic and political implications, research findings often are newsworthy. Indisputable cause-and-effect research findings about possible cancer-causing substances, for example, would be information everyone would like to know and information that conceivably could wipe out entire commercial markets. Lacking indisputable results but having a large field of "expert scientific researchers" available, the various forms of news media legitimately report on whatever pieces of the puzzle are available. As in any other business, the reporters' skills in relating that information and putting it in perspective vary greatly. Readers' or listeners' abilities to understand the information and put it into perspective vary even more; especially when most of them are not specifically trained for that kind of skill.

Neither the scientific research system nor the political/media system is likely to change in the foreseeable future. It's important, therefore, to educate youngsters about the interaction between these systems and to give them practical skills to cope with the constant flow of information.

Much of the time there is incomplete information available for our decisions in life, especially the most important ones. Our decisions need the best information available at the time and our best judgement. Part of judging new health information is having an understanding of how health research is conducted and what is reasonable and realistic to expect from it. The following basic concepts provide a strong foundation for that understanding:

- Research Yields New Knowledge But Also Uncovers New Questions.

In most health areas, a body of knowledge is regarded as "currently accepted fact" and a set of questions outlines what we don't know and are trying to find out. High-quality studies yield both new information about the facts and revised versions of the remaining questions.

- Legitimate Scientific Controversies Exist.

Different scientists give conflicting or seemingly conflicting messages about certain topics because they are interpreting "current facts" differently; because they are willing to differing degrees to extend the usually incomplete facts into lifestyle recommendations; and/or because they are conducting studies that explore different variations of complex questions.

- Most Research Questions Take A Long Time To Investigate.

There are very few sudden, astonishing results. "Long" usually means years and can stretch into decades. This is because there are many, very strict requirements for research to yield supportable conclusions; because the effectiveness of a treatment or preventive action may take years to become measurable; and because basic research often goes through several further stages of testing, into clinical research and demonstration projects. In addition, results must be replicated and agreed on by other scientists.

- Health Messages Based On Research Can Change As Scientists Discover New Knowledge. Meanwhile, People Make Health Decisions Daily.

As scientists learn more about the mechanisms of health and disease, they must refine or revise their own ideas and advice to the public. Thus, youngsters must learn to deal with change and to adapt health decisions to new information instead of "turning off" when new information conflicts with previous "truths". Because knowledge and uncertainty are mixed in all health areas and legitimate controversies exist, there are not as many "absolute answers" to health questions as we would like to have. While health knowledge is constantly evolving, however, youngsters must realize that they face daily health decisions now, including choices about eating, sleeping, exercising, smoking and taking medication. Informed health decisions, therefore, use the best information available at the time.

- Researchers Draw Conclusions From Studies of Large Groups Of People. Conclusions About "Risk Factors" Are Guides To Individuals, Not Guarantees.

Research results draw conclusions from differences in large groups of subjects. The results do not necessarily apply to every individual, and individual exceptions do not invalidate the conclusions for others. Science can help us make choices by identifying actions that probably will enhance health or increase the risk of disease.

Understanding the concept of a risk factor can allow students to see how research results bring information to health decision making. It's extremely important, though, that "risk" be understood in its appropriate context. Psychological and social development, especially during teen years, requires that youngsters learn how to take risks. Teenagers frequently do not discriminate among risks, often seeing risk-taking as a way of demonstrating "bravado" rather than selecting some reasonable risks as a constructive way for learning how to meet new challenges in life. The concept of "risk factors" is different. It involves increasing or decreasing the probability of disease and/or death by engaging in or avoiding a disease-related behavior over time.

Some students point out that there are health risks all around us, and say that heeding health messages would make life overprotected and dull. In response to this, a discussion about driving can provide a helpful parallel. There is some risk of injury or death associated with stepping into a car to go somewhere. That doesn't mean we should stop using cars. However, certain reasonable and prudent actions can be taken to lower the risk of death and disability from auto accidents. These include wearing seatbelts, keeping the car in good mechanical condition, not exceeding the speed limit and not drinking alcohol before driving. Even taking all of these actions won't guarantee that a driver will never be injured or killed in a car accident; but they will significantly lower the risk. It's also possible that a drunk driver without a seatbelt in a mechanically faulty car could speed from one place to another and not necessarily be injured or killed; but the risk is much higher. If the driver does avoid an accident that doesn't mean all auto safety precautions are useless and should be ignored.

Similarly, there are reasonable and prudent actions to take to lower disease risks. In the cardiovascular area, these actions include not smoking, getting blood pressure checked and keeping it under control if it's high, controlling weight and being physically active. Doing these things won't guarantee avoiding cardiovascular disease, but they lower the risk. Some who ignore this advice may not develop cardiovascular disease, but their risk of disease is higher. Even if they "escape", that doesn't invalidate the value of preventive actions.

Teenagers must understand the "risk factor" concept if they are to successfully use current and future health research information on cardiovascular disease. The concept is also applicable to many other health topics.

- Research Can't Answer Some Questions Expeditiously Because There Are Ethical Considerations. Because Scientists Don't Put People Into Experimental Extremes That Would Harm Them, It's Difficult To Get Clear-Cut Answers To Many Research Questions.

Epidemiological research collects information about large populations over time, usually without "experimenting" on them, and makes statistical connections between certain factors. For obvious reasons, much research on humans is epidemiological; our society doesn't condone using masses of people as "guinea pigs." Research involving experiments on humans is very carefully regulated and uses procedures which minimize danger to participants.

Because we don't put human subjects into experimental extremes, however, it's more difficult to get clearcut answers to many scientific questions. The scientific methods used are humane, but are often less direct and take longer. A major challenge to researchers is to develop research designs that are humane yet scientifically "tight" enough to yield meaningful results. Elements like sample size and composition, duration of the study and controls for other variables are important.

APPLYING CRITICAL THINKING APPROACHES TO REPORTS OF HEALTH NEWS

A youngster who understands the foregoing basic concepts about research will be more likely to avoid the trap of an "extreme" reaction to health news; i.e., either ignoring it totally or basing a lifestyle decision on a single report. This is especially important in relation to television and radio news reports (which are very brief and are over before they can be re-read or studied), and news heard "second-hand" from peers or adults.

Television and radio reports can trigger further investigation and critical analysis. If a scientific study is newsworthy, written reports usually appear in newspapers and magazines the same day or week it is covered by the electronic media. Gathering a variety of news reports on a particular study or set of research results is one helpful way to work toward conclusions because comparing the reports may point out gaps and controversies.

The following is a sample "Critical Thinking Checklist" to help assess media reports about research results. Students will discover that most news reports answer only some of these questions. Teachers should then encourage students to analyze what information is given and what information is missing from particular news reports, and how new health information can contribute to their personal health decision making.

Credibility of the Source

A. What is the source of the research results?
B. Who paid for the study? Do the funders have any economic or other stakes in the research results? What is the probability for objectivity or bias?
C. Has any agency or organization responded to the announcement of research results? Do they have any economic or other stakes in the results? What are the probabilities for objectivity or bias?
D. Is the reporter known for prior experience in reporting on scientific research?

Factors in the Study Design

A. What type of research was done? Was the research at the "test-tube" stage, animal testing stage, or human testing stage?
B. Over what period of time did the study take place?
C. How many subjects were in the study?
D. Did the subjects have particular characteristics? (age range, male or female, past disease history, etc.)
E. Was there a control group for the study?
F. Have all relevant variables been considered?

Interpretation of the Results

A. How are the results being stated? Are there "qualifying" words that limit the applicability of the results (such as "in animals", "some", "may", "probably")?
B. Do the results depend on a measurement of change? If so, is there an indication of the significance of the change (either statistically or biologically)?
C. Has the study been repeated by other researchers, with similar results?
D. Does the article differentiate between "fact" and "opinion"?
E. Does the study deal with a "risk factor"? If yes, do the results identify actions which will probably enhance health or probably increase the risk of disease?
F. Are the results part of an ongoing scientific controversy? If so, what side of the controversy has been given added weight by this study?

Application of the News

A. Does the article make clear what is known and what is not known about the research topic?
B. Does the article note what questions remain after the study and/or what new questions it generates?
C. Are the research results reported in this article relevant to one of my personal health decisions? If so, is there enough information in the article to make me consider changing one of my decisions? Do I need to obtain additional information?

LOCATING ADDITIONAL HEALTH INFORMATION RESOURCES

Usually one news report about a research result will not give sufficient information for a person to make or change a health decision. It then becomes important to know where to look for other "pieces of the puzzle."

There are several possibilities for obtaining further health information, and the helpfulness of different resources will vary from locale to locale. General categories include:

- health professionals (health educators, nurses or physicians, or other health professionals);
- state and local health agencies;
- state and local education agencies (health-related components);
- local chapters of voluntary health organizations;
- local chapters of professional medical associations;
- hospitals, especially university medical centers;
- community health education centers;
- libraries, especially for both lay and professional journal articles, and other references; and
- telephone "yellow pages."

As a class activity, students could explore these resources and compile a "Directory of Local Health Information Resources" for their school's students and families. This would connect students with health information resources in their own community through actual contacts, result in a usable reference document and provide a valuable, real-world service for the students and their families. Perhaps the school, PTA or a local health organization could publish it.

In addition, developing this skill in students would make them more aware that new health information does exist and is available to interested consumers. In fact, all three skills described in this article would contribute to student awareness of new health information. Some teachers may want to begin a unit on informed health decision making by increasing awareness about multiple information resources. Next, an emphasis on understanding the research process and analyzing reports of research results could be included. Then the unit could come full circle by exploring ways to locate additional information on particular topics.

Students can apply their understanding of basic research concepts and their critical thinking skills to the new information they locate. The informed decision making process then may be improved by a self-generating process.

SUMMARY AND RECOMMENDATIONS

Consider again the brief television news report scene at the beginning of this article. Students who have learned the concepts and skills outlined here will be able to put such a report into a general context of how research operates, locate written news pieces about the topic, ask analytical questions about the report, and know where to go for further information. The information they use in their health decision making can be more accurate and more meaningful. It's even possible that the ability to begin to understand "the experts," to ask knowledgeable questions, and to find useful answers could in itself help motivate students to give more thought to their health decisions and lifestyle habits. These are all exciting potentials.

We urge those involved in school health education to examine and discuss these research concepts and skills. We welcome comments about adapting them for practical classroom use and evaluating their impact on students. If the concepts and skills seem beneficial, avenues to consider include: possible incorporation into professional preparation programs; the development of innovative curriculum materials; pilot programs for and feedback from teachers and students; illustration through film or television; and involvement of state or local health-related organizations, both public and private.

One translation of the research concepts and skills into classroom materials has already begun. NHLBI has provided the thoeretical framework described in this article, and consultation, for the Teenage Health Teaching Module titled "Using New Health Research." The module was developed and pilot-tested by the Education Development Center, through interagency cooperation between NHLBI and the Centers for Disease Control. The pilot test has given promising preliminary indications of the usefulness of teaching the research concepts and skills.

Health decision making is a complex process influenced by many factors. Health information is one of those factors. How much information a person has, how accurate it is and how much value the person gives it all interact with other factors and impact on health decisions. Skills to better understand current health information and to better cope with new findings as they become known and publicized could help youngsters become more effective health decision makers for the present and future.

Statistics and Probability: A Sure Thing for Elementary Classrooms

By Marilyn Burns

Television executives meet in the boardroom to decide which programs will get prime-time viewing and which shows will be canceled. A basketball coach calls time out to set up a play that will free a certain player for a three-point shot. A city official announces that the stop sign at a particular intersection is being replaced by a traffic light. Supermarket managers arrange thousands of products--some on top and bottom shelves, others at eye level, and a few near the cash register. A sporting goods manufacturer produces a certain number of left-handed fielders' gloves. A jean manufacturer meets with consultants to decide how many pairs of each size to sew. Executives in an automobile insurance company set rates that are astronomical for teenage boys. State lawmakers debate making it mandatory for motorcycle riders to wear helmets.

Decision making situations such as these and an untold number of similar ones are daily occurrences in our society, and very few of us, if any, escape their impact. Significantly, each of the decision makers, to act with any assurance, draws on ideas and techniques rooted in the mathematical areas of statistics and probability. They examine all available data--distinguishing between what is pertinent and what is not--before arriving at what is hoped to be the best conclusion. The process is deliberate but uncertain--the classic example of making an educated guess. That, essentially, is what statistics and probability are about--making decisions concerned with human problems where there is variability in the information to be considered and uncertainty in the conclusion reached. Making decisions in this way is an integral part of our culture.

Whether or not your students will be the people directly responsible for making such decisions, it's important that they understand how such decisions are reached. Without such understanding, students have an incomplete view of the world in which they live and of the forces that influence each of them personally.

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Children will never reach such an understanding, though, unless teachers make statistics and probability an integral part of mathematics instruction in the elementary grades. And that is not an unreasonable suggestion. Statistics and probability are essential aspects of numeracy. They are akin to the aspect of numeracy that has to do with a feel for numbers, an appreciation for appropriate levels of accuracy, an understanding of the order of magnitude of an answer. Examples of using numbers in everyday life are largely statistical. How much paint or wallpaper should you buy for a room? At what time do you need to leave to pick up a friend so that you will arrive at a concert on time? Which bank account should you choose? When does the roast need to be put into the oven to be ready in time for dinner? Should you increase the amount of insurance on your home? All of these decisions are made with variability--with some degree of uncertainty--in mind. And they require the decision maker to have a sense of whether it's wiser to overestimate or to underestimate. To be sure, these everyday decisions also involve arithmetic, the aspect of numeracy that receives the bulk of the educational focus in the elementary grades. But being skilled in arithmetic--being able to add, subtract, multiply and divide--is in some ways the least important aspect of numeracy, especially since calculators are more reliable, more efficient and inexpensive. Simple arithmetic is needed, but in a broader context of numeracy that includes statistics and probability.

Mathematics will become even more statistical in our technologically advanced future, and the world will become increasingly flooded with statistical data as information rapidly becomes our most abundant national resource. That's why concepts and skills in statistics and probability need to be included in today's math instruction to children.

WHAT ARE STATISTICS AND PROBABILITY

Statistics is the science of studying data. Making statistical studies involves collecting, organizing, presenting, analyzing and interpreting information. The pertinent information is not always readily available or precise. That's why variability is an element. Most often, more than one course of action is possible; that's why uncertainty is involved. Probability provides a way to measure uncertainty and is therefore essential to understanding statistical methods.

Statistical understanding helps people make more informed personal decisions. A graph in the newspaper provides statistical information about seat belt use in automobile accidents that have resulted in either injury or death--do you wear them as a result? A campaign notice presents a candidate's position on the death penalty and provides statistical information about whether the death penalty is a deterrent to crimes of murder--how do you vote? News reports link smoking to cancer--do you choose not to smoke? The dangers of nuclear power plants are reported along with statistics that show our need for this source of energy--what position do you take? Your decisions depend on the sources, accuracy, completeness and reliability of the data.

Experience with collecting and interpreting data is necessary for learning to make statistical judgments. Using concepts of statistics and probability to consider personal issues can encourage students to report results faithfully, to face up to their prejudices, to think more consistently about arguments, and to justify their thinking with numerical information. Statistics and probability can help students learn to look at problems more objectively, especially when investigating complex issues. Children also practice arithmetic skills and develop their critical thinking abilities when involved in real-life applications of math. Interestingly, however, the brightest students often resist investigations when they're unable to be absolutely sure of the correctness of their thinking. Their unwillingness to risk being wrong can change, though, for approaching situations statistically encourages all students to validate their thinking with data.

In the elementary grades, students should experience concepts in probability and statistics in an exploratory way, rather than by focusing on the formal development of the theory of probability. Experiments should involve children firsthand with numerical explorations where variability and uncertainty are inherent. In these experiments, children's intuitions are challenged first. After children predict what "should happen," they do the experiment and compare the results with their predictions. Such experiments provide students with firsthand experience in collecting, organizing and interpreting data as well as reinforcing computation skills.

A SAMPLE LESSON

An example--a lesson I conducted with sixth graders--may help ground this treatise in classroom reality. The impetus for the activity came from a short item in the Sunday newspaper: "Write the numbers 1, 2, 3 and 4 on a piece of paper. Ask somebody to circle any one of these numbers. Four out of five so asked will circle the 3. Yes, four out of five."

I duplicated small slips of paper with the numbers 1, 2, 3, 4 written on each and gave each student a slip. I then asked the students to circle one of the numbers and to turn their papers facedown without discussing their choices. I also asked the students to write individual predictions, without discussing them with anyone. Their predictions were to be hypotheses about two things: (1) Do you think that any one number will have been circled lots more than any other number, and if so, what number is it? (2) Why do you think that? When they had written their individual predictions, I asked them to discuss their thoughts within four-student work groups with the goal of coming to a group opinion. They were also free to discuss which numbers they had circled. I asked each group to choose a spokesperson to report to the rest of the class.

Without knowing what the class data showed, we discussed and compared the group theories. All groups felt that one number would come up more than the others. Of the seven groups, none felt that the number would be 1, two of the groups felt it would be 2, four groups voted for 3, and one group chose 4. Their reasons were diverse, ranging from "Americans like to be best, and since 4 was the biggest number, people would think it's best and choose it," to a justification for choosing 3: "It's what we all picked."

I read the entry from the newspaper aloud--reporting that four out of five people who did the experiment circled the number 3. Then I wrote the four numbers--1, 2, 3, 4--on the chalkboard in a column. Students used small pieces of masking tape to attach their slips of paper to the board next to the matching number. (It might have been easier to have the students tally their results, but they hadn't had much graphing experience and I wanted to show the benefits of using graphs to organize data.)

The graph showed that 15 of 28 students had circled the number 3. "Did more or less than 50 percent of the class choose 3?" I asked. Mark said that 15/30 would be half, and that 15/28 was a larger fraction. Abby offered a different explanation: "It's more than 50 percent of the class because 15 is more than half of 28." In the meantime, Andris had done the long division by hand, and Scott had used his calculator. Their results agreed: 53.5 percent of the class had circled the number 3. During this discussion it became clear that some students did not understand percentage, or if they had an intuitive feel for the concept, they were at a loss as to how to compute it. Although I chose not to deal with that issue at the time, I didn't want to avoid talking about percentages, for I believe that when concepts are talked about as they arise, students have a good opportunity to gain insights.

"According to the newspaper," I said, "the chances are that four out of five people asked to circle a number will circle 3; mathematicians would write that probability as 4/5." I asked if 4/5 was more or less than 53.5 percent and got general murmurs of "more." "What percent is it?" I asked. "Eighty percent" came the answer with considerable sureness.

I told them that the four-out-of-five information doesn't promise that if you try the experiment on five people, four of them will circle 3 and the other will circle one of the other numbers. What the theory of probability does promise is that if you do this experiment many times, the more times you try it, the closer the results will come to that 4/5 probability.

I never would have attempted this explanation of probability without first giving students some concrete experience with the concept. If I had, students would have been forced to try to internalize the concept and to learn the abstract terminology simultaneously. That kind of teaching can lead to confusion, not learning.

I explained to students why I had prepared the slips of numbered paper instead of having them make their own. (Usually I give students the responsibility of taking care of such details.) I told them that it was a way of keeping the experiment "fair," of making sure they each had the same experience, which is another aspect of probability. I had also tried to space the numbers evenly, writing them all about the same size, so that no one number would attract more attention than any of the others.

I raised several questions to get students thinking about designing different experiments: What would happen if adults were sampled instead of sixth graders? Would 3 still be picked if the numbers were scattered on the slip of paper? What would happen if the numbers were written in a line, but in a different order? What would happen if, instead of numbers, we used letters of the alphabet or shapes? There were many possibilities for further investigations, and pairs of children eagerly set out to plan and conduct their own statistical studies.

Throughout this lesson, students got involved in a way that is always gratifying in the classroom. Among the reasons for their spirited participation is the fact that the experiment was real, controlled by the actual classroom statistics we collected. And unlike much of children's school experience—where finding the right answer is the major goal, where right and wrong are already decided, and where making conjectures or predictions is not called for or valued--this activity gave individual students the opportunity to predict, then to consider their conjectures in light of others' thoughts. Being right or wrong was not the issue. Rather, the point was to test personal predictions against reality and then to reevaluate.

In this activity there was, from the start, a degree of uncertainty about the outcome. Students formed a statistical hypothesis that they then evaluated with numerical information. They applied number skills that they had learned in school to help justify their thoughts. But because their information was limited to six graders' responses, and was not a random sample, it could not be compared to the newspaper claim. The students understood the problem, demonstrating that the exploration was, among other things, an exercise that developed critical thinking. Experience with, not mastery of, statistics and probability was the primary goal, and the result was an activity that added to students' intuitive understanding of mathematical concepts.

TEACHING CONCEPTS IN CONTEXT

A popular, but backward, means of presenting curriculum calls for concepts and skills to be identified first. They are then placed into a sequence and, perhaps, further organized into a timetable of instruction. After being taught more or less in isolation, concepts and skills are usually followed by their applications.

This approach--which does not make sense in statistics and probability, or in any other area of study--is just the reverse of what should be. Students should see the problems as the meat of the experience, with skills serving to solve those problems. Concepts and skills need to be identified and organized, but they must be taught within the context of their usefulness. Instructional emphasis needs to be on students' active involvement in solving problems. The teacher's task is to find appropriate problems from everyday life and from all areas of the curriculum that require use of concepts and skills related to statistics and probability. Not all concepts and skills will be suited for each activity, nor do they necessarily have to be analyzed when they are used. Students vary in their ability to understand the concepts and skills, and stressing techniques can hinder rather than enhance their understanding.

FURTHER CLASSROOM ACTIVITIES

All classroom experiences should highlight the usefulness of techniques in real situations. Consequently, the following classroom-tested activities require students to draw conclusions from data they collect themselves. Using false or fictional data would risk giving students the message that statistical techniques and skills are more important than the investigation of a problem.

- Cubes in the Bag. This activity uses sampling to predict how many of each color cube there are in a collection.

In a small paper bag, place ten cubes, some of each of two different colors. Tell the class what you've done without saying how many of each color there are. Circulate among the students, asking individuals to draw a cube without looking in the sack. Record the color that was drawn, either by tallying or by marking a graph, and have the student replace the cube. (You may want to have a student do the recording on the board as you circulate.) Shake the bag and have another student draw. Repeat this procedure for ten draws. Then ask students to look at the information and decide whether they are willing to predict what is actually in the bag or if they need more information. You may want students to discuss this question in small groups first and then to report their group opinions. Groups may not be willing to make an exact prediction, but they may express an opinion about what's likely or offer a range of possibilities.

Do ten more draws. Again have groups formulate and share opinions. Repeat as many times as needed for most of the class to be willing to predict what is in the bag. (For younger children, simplify the prediction to deciding if there is more of one color than the other in the bag.)

Some students may formulate opinions by combining a smattering of intuition with hopeful prediction. Others may utilize the information with more of a sense of ratio and proportion. When most groups have arrived at an opinion, and/or interest in further samples is waning, empty the contents of the bag. Compare the predictions with the actual contents. Repeat the activity on following days, having pairs of children conduct the experiment. Let students see their teacher as a learner by participating in predicting along with the class, then raise the following questions:

- Why did you shake the bag after each draw? (This randomizes the draw each time.)

- With two colors, what combinations might be in the bag? (There are nine possible arrangements, from nine of one color and one of the other to the reverse. This is called the sample space.)

- Why did we replace the cube after each draw? (Otherwise, the bag would soon be empty and there would be no experiment.)

- How large a sample is needed to make a reasonable prediction? (Answers will vary. The important concept is that the larger the sample, the better able you are to make a reasonable prediction.)

• Sampling Beans. This activity involves students in using sampling to determine the composition of a collection of beans. It differs from the cube activity in that students do not verify their predictions by counting. As in real applications, sampling is used because investigating the total population would be impossible or unreasonable.

In a paper bag, mix one package of white beans with three of brown beans. Choose bean packages that are about the same size.

Seat children in small groups. Tell them you bought some packages of each kind of bean and that they are going to do some sampling to see if they can figure out how many packages of each kind you bought.

Have each student take a small handful of beans and sort them into two groups, making individual concrete bar graphs. (Provide young children with graph paper to help them organize their beans into two rows.) Ask each child to predict, based on her sample, how many packages of each kind of bean you bought.

Then have children in each group pool their samples and arrange all their beans into two rows. Ask each group to make a prediction about how many bags of each kind of bean you bought. Record the group opinions and ask each group to reveal how it made its decision.

Now pose another problem. If each student drew four beans from the sack, there would be five possible outcomes: 4 white, 3 white and 1 brown, 2 white and 2 brown, 1 white and 3 brown, 4 brown. List these on the board. Ask students to predict, in their groups, which result would occur most in the class, based on the sampling done so far. (While they are deciding, collect their beans.) After the groups report their opinions, circulate and have each student draw four beans without looking in the sack. Have individuals tally their samples next to the corresponding descriptions on the board and discuss the class outcome.

Ask the groups again to predict how many packages of each color bean you purchased. Then discuss the following: How did your individual samples compare with your group samples? How did the second class experiment change or support your first group prediction?

- Spinner Experiments. This activity leads children to compare ideas about probability with actual results.

Before doing the activity, each student needs to make a spinner. Demonstrate how to make one following the directions provided on the next page. Then have students make theirs; each needs a 5-by-8 index card, scissors, pencil, one paper clip, some masking tape, and a compass or some other way to make a 3-inch-diameter circle. Each student also needs a 3-square-by-12-square piece of graph paper for a record sheet.

HOW TO MAKE A SPINNER

1. Cut a 3-inch circle from one end of a 5-by-8-inch index card. Poke a small hole exactly in the circle's center.

2. Divide the circle in half by drawing a line through the middle of it, and mark one half with a 3. Divide the unmarked half into two equal parts and label one 1, the other 2.

3. From the leftover card, cut a square that's a little larger than the circle. Poke a hole through the center of this, too. Draw a line from the center to one corner.

4. From the scraps, cut three little squares, each about 2 cm on a side. They'll be used as washers. Poke a hole through the center of each and crimp them a bit.

5. Bend the outside leg of a paper clip perpendicular to the rest of the clip.

6. Cut a piece of masking tape that's about 4 cm or 5 cm long.

7. Assemble the spinner by first poking the paper clip through the large square. Tape it on the bottom to hold it in place. Then put the three washers on.

8. Put the round spinner face on next.

9. Cover the point of the paper clip with a piece of tape.

10. Now it's ready to spin.

When everyone has a spinner, ask: Is one number more likely to come up than any other when you spin the spinner? Why do you think so? Then explain that each student will do an experiment to test her opinion, spinning her spinner and recording the number that comes up each time. Students stop when one number reaches the top of their graphs. They then record how often each number came up and post their graph record sheets to show which number "won." (Provide bulletin board or wall space with sections labeled 1, 2 and 3.)

Have groups of students compile their statistics and record the totals on the board. Calculate and discuss the class totals. Did the numbers come up in the proportions predicted? How did the class sample differ from the individual or small group samples?

Have students work in pairs to do a second experiment. Each spins his spinner, and the two add the numbers that come up. There are five possible sums--2, 3, 4, 5 and 6--so each pair needs to cut a record sheet that is 5 squares wide and 12 high. Students record as they did for the first experiment. Before they begin, however, students should make predictions about which sum will "win." (Students most often predict 6 because the space for 3 is much larger than the space for 1 and 2. This sum is not the most likely though; the sum 4 should occur most often. Older students may be interested in analyzing why.) Label wall space for the sums so that as students complete the experiment they can post their results.

- Alphabetical Probability. In this activity, students use probability and statistics techniques to analyze the frequency of letters in the English language.

Ask students to decide individually which five letters of the alphabet are used most often. Have them list their predictions, starring the letter they think is the most common.

Have small groups of students compare their individual predictions, then arrive at and report group opinions. After comparing the group predictions, each student picks a sentence from a book and tallies how many times each letter appears in that sentence. The small groups then compile their members' results and record the totals on the board.

Have a committee find the class totals and list the letters of the alphabet in order of frequency, as determined by students' findings. Compare this order with the following: E, T, A, O, NI, S, R, H, L, C, D, U, PF, M, W, Y, BG, V, K, QX, JZ. (Letters not separated by commas have the same frequency of occurrence.)

Ask the class who might find this information useful. (Manufacturers of type, makers of bulletin board letters, press-type producers, people who do cryptograms.)

Show students the following three sentences and ask what is unusual about them: "This is odd. Do you know why? Try and find out." (There are no e's.) Have students try writing a paragraph without using the letter e.

Let interested students examine the games of Scrabble and Boggle to see how the games' inventors made use of the information about the frequency of letters.

- Two-Handed Investigation. In this activity, the class investigates if, by taking a sample of the school's students, it can determine approximately how many right-handed people there are for every left-handed person.

Investigate the right-handedness and left-handedness within the class first. Have young children make hand prints or tracings of the hand they write with on uniform squares of paper. Paste the squares on a large chart in two columns, making a pictorial graph. Older children can tally or color in squares to make an abstract graph of this information. In either case, discuss what the graph shows and figure out how many right-handed people there are for each left-handed person in the class. (The remainder of this activity may be too complicated for young children; use your judgment.)

After revealing how many people there are in the school, discuss with your students how large a sample they think they need to determine the number of right- and left-handers in this population. (If they feel that a class is a reasonable-size sample, their own will serve as a basis for comparison.) Have students decide who will take the sample, where it will be done, and how the data will be recorded. Students later interpret their data, and estimate the ratio of right-handers to left-handers at school. Have them compare this estimate with their class sample.

Finally, have pairs of students visit all the classes to find out how many right-handers and left-handers are actually in the school. Discuss the results of this census and compare them with the results from each of the samples. Ask whether students were satisfied with the sampling procedure or if they would change it. Have students, individually or in pairs, write reports of the experiment.

- Student Samples. Have interested students do sampling individually or in pairs to:

  - Determine who generally picks out students' clothing--the students or their parents.

  - Learn how many people there are with each eye color.

  - Learn about students' weekly allowance.

  - Determine students' favorite TV show.

THE SIX CENTRAL IDEAS OF STATISTICS AND PROBABILITY

The following basic ideas in statistics and probability are appropriate for elementary students and can be presented by means of challenging, motivating and problem-solving situations:

- Collecting Data. The 1, 2, 3, 4 activity is an example of taking a factual census and collecting numerical data. Students need experience gathering data involving opinions as well. Have them design methods of collecting such data without introducing a bias.

- Sampling. Even when information is needed about an entire population, it is often possible to contact only a part of the group. If gathered correctly, however, limited information can be used to make generalizations about a total population. Find a way to demonstrate the difference between random and non-random samples, and the importance of this difference in statistical studies.

- Organizing and Representing Data. In the 1, 2, 3, 4 activity, the actual response slips were organized into a concrete bar graph. Give students experience organizing data and representing the information in a variety of graphs--bar, picture, circle, line, scatterplots and so on. (For activities involving a variety of graphs, see "Graphing Matters" on page 38.)

- Interpreting Data. Have students practice reading graphs so that they are able to make quick visual summaries as well as to formulate interpretations and comparisons by finding means, medians and modes.

- Assigning Probabilities. Initial experiences with measuring uncertainty should be informal discussions about whether a result is possible or likely. Have students talk about different outcomes in terms of being equally or not equally likely. Assigning probabilities (represented by numbers from 0 to 1) gives further information. For example, show students why the probability of getting a 4 when rolling a die is 1/6 and why the probability of rolling an even number is 3/6.

- Making Inferences. Students need to draw conclusions and to make predictions based on their interpretation of data. Give them opportunities to justify their thinking with numerical information they collect and analyze.

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